

TECHNOLOGY DEPT:

A PICTORIAL SURVEY OF CURRENT PRACTICE, EQUIPMENT AND MATERIALS

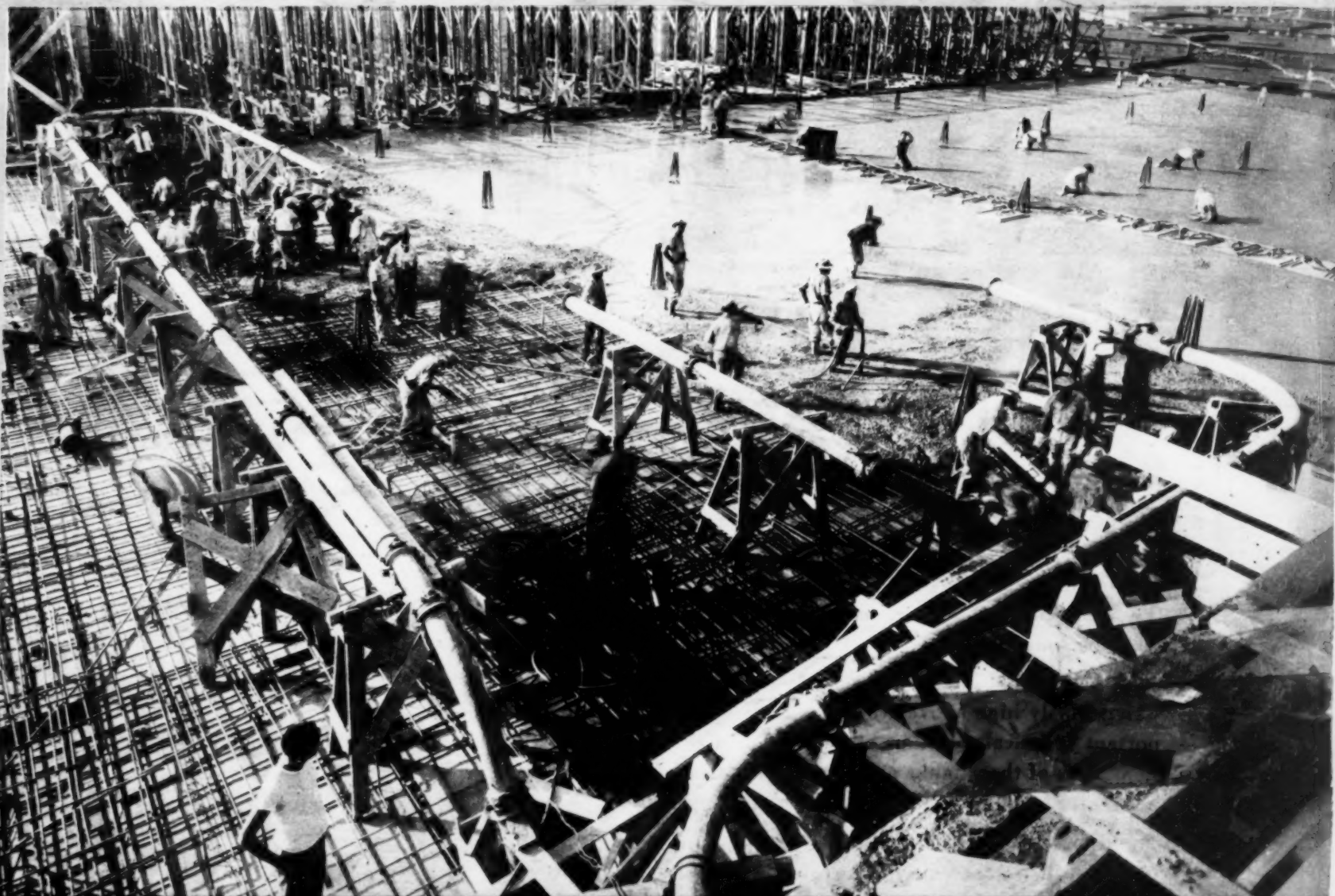
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✓ DETROIT

Construction Methods

MCGRAW-HILL PUBLISHING COMPANY, INC. • PRICE 20 CENTS



PIPE LINES CARRY PUMPED CONCRETE to floor slabs of 4-story warehouse at Philadelphia Quartermaster Depot.

JANUARY
1942

Defense Housing Employs Insulating Board Panels for Walls and Roof • Denver Ordnance Plant Comprises 178 Buildings • Tunnel Mucking with Modern Equipment and Methods—By H.W. Richardson and R.S. Mayo • Ford Bomber Plant has 62-Acre Main Assembly Building • Underground Garage Occupies Entire City Block



THESE TANKS . . . of Inland Steel—are also Vital for Defense

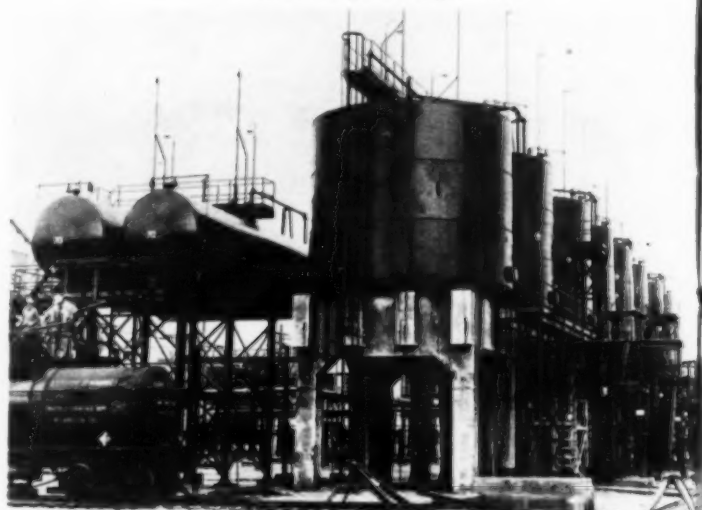
Combat tanks are, of course, a vital necessity for modern warfare. But they are not the only tanks. There are others — tanks which will never cross a battlefield, nor be featured in the headlines, or in picture magazines. These tanks are also vital for America's defense.

Filled with gasoline or oil at our off-shore bases, carrying the water supply high above ground at army camps, bearing important chemical solutions at scores of new defense plants — thousands of these tanks are playing their nonspectacular but essential part in our country's great defense program.

For their construction, Inland is regularly producing large tonnages of plates and other steel products. Just as for bomber plants—and ships—and shells—and countless other defense requirements, Inland is bending every effort to deliver steel for these tanks when and where it is needed. For National Defense is Inland's No. 1 Job!



Two 25,000-bbl. pressure tanks built of Inland Steel in service at a powder plant.



Acid for the production of explosives is stored in these tanks at an Army Ordnance Works. Inland Steel was used for their construction.

INLAND STEEL CO.

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Next Month

Annual Road Builders' Number
of CONSTRUCTION METHODS

CURRENT JOBS

.... and Who's Doing Them

BUILDINGS

Public—In Geneva, Pa., **Fraser-Brace Engineering Co., Inc.**, of New York, was awarded \$35,000,000 War Department contract for Keystone Ordnance TNT plant. **Sheffield Steel Corp.**, of Kansas City, Mo., will build blast furnace and steel plant in Houston, Tex., for \$22,670,855, to be financed by Defense Plant Corp. **E. I. du Pont de Nemours & Co.**, of Wilmington, Del., was awarded \$15,000,000 War Department contract to construct an additional unit for Morgantown Ordnance Plant at Morgantown, W. Va. **Ross B. Hammond Co.**, of Portland, Ore., received \$12,000,000 War Department contract for foundation work and excavation for aluminum plant in Troutdale, Ore., to be financed by Defense Plant Corp. **Austin Co.**, of Cleveland, Ohio, will design and construct dolomite ore plant and magnesium refining plant in Austin, Tex., for Union Potash Co., at cost of \$11,747,000; Defense Plant Corp. will finance. In Alexandria, Va., **Starrett Bros. & Eken, Inc.**, of New York, will erect 1,800 two-story, brick or local stone residences at estimated cost of \$7,000,000. Defense Plant Corp. will finance \$4,000,000 plant addition for Copperweld Steel Co., at Warren, Ohio, to be built by **Uhl Construction Co.**, of Pittsburgh, Pa. **Maurice L. Bein**, of Bridgeport, Conn., will build the Outhwaite housing project in Cleveland, Ohio, for \$4,943,000.

Stone & Webster Engineering Corp., of Boston, Mass., will construct 1-story brick and steel machine shop and 1-story foundry at Indian Orchard, Mass., at estimated total of \$3,000,000, to be financed by Defense Plant Corp. In Chicago, Ill., the **Frances Cabrini Homes**, comprising 586 units, will be built by **S. N. Nielsen Co.**, local contractor, for \$2,478,470.

HEAVY CONSTRUCTION

At Melville, R. I., **Leonard Construction Co., Inc.**, of New York, will construct underground storage tanks, heating plant, sewerage system, etc., for \$4,250,000 on cost-plus-fixed-fee basis. At Sparrows Point, Md., shipways are under way for Bethlehem Shipbuilding Co., for approximately \$2,000,000; **McLean Contracting Co.**, of Baltimore, was awarded contract. Successful bidder for floating drydock contract in New Orleans, La., was **Chicago Bridge & Iron Co.**, of Chicago, with bid of \$2,500,000, to be financed by Defense Plant Corp. Airport improvements at Greenville, Miss., are being made by **M. T. Reed Construction Co.**, of Belzoni, for \$2,181,225. Contract for steel floating drydock at North Bergen, N. J., went to **Harris Structural Steel Co.**, of New York, at price of \$2,500,000; Defense Plant Corp. will finance.

HIGHWAYS

Among recent highway and bridge contract awards are the following: California: \$359,902 to **N. M. Ball Sons**, of Berkeley. Colorado: \$341,881 to **De Romer & Atchison**, of Littleton. Florida: \$345,431 to **Duval Engineering & Construction Co.**, of Jacksonville; \$262,870 to **M. C. Cadell**, of Jacksonville; \$642,666 to **Ebersbach Construction Co.**, of Tampa. Georgia: \$273,910 to **L. T. Barber**, of Moultrie. Kentucky: \$480,358 to **Hart & Hart**, of Columbus, Ind. Montana: \$257,816 to **Union Construction Co.**, of Great Falls; \$216,955 to **Peter Kiewit Sons Co.**, of Omaha, Neb. Missouri: \$239,936 to **Harrison Engineers & Construction Co.**, of Kansas City; \$333,769 to **O'Dell & Riney Construction Co., Inc.**, of Hannibal. New York: \$350,416 to **B. Turecamo Contracting Co.**, of Brooklyn, N. Y. New Jersey: \$485,590 to **Jannarone Construction Co.**, of Belleville. Pennsylvania: \$583,243 to **Fred Berlanti & Son, Inc.**, of Harrison; \$913,395 to **F. D. Kessler, Inc.**, of Northumberland; \$895,502 to **Pennsylvania Quarry Stripping & Construction Co.**, of Hazelton; \$405,454 to **H. J. Williams Co., Inc.**, of York; \$412,634 to **Francis A. Canuso & Son**, of Philadelphia; \$420,891 to **C. W. Good**, of Lancaster; \$300,001 to **A. W. Hinaman**, of Williamsport.

CONSTRUCTION METHODS was founded in 1919, under the name of SUCCESSFUL METHODS, by the Manufacturers' Publicity Bureau, Inc., of Chicago, representing a group of non-competing manufacturers of construction equipment. Charles R. Thomas, editor of the first few issues, was succeeded by William Jabine. In 1926 the McGraw-Hill Publishing Company, Inc., of New York, purchased the publication, changing its name to CONSTRUCTION METHODS in November of that year, to CONSTRUCTION METHODS in May, 1927, and to CONSTRUCTION Methods and Equipment in December, 1936. In October, 1939, the name CONSTRUCTION METHODS was resumed. All rights to the foregoing titles are reserved by the publishers.

Robert K. Tomlin was appointed editor of CONSTRUCTION METHODS in January, 1928. Vincent B. Smith is associate editor; N. A. Bowers, Pacific Coast editor; Nelle Fitzgerald, assistant editor; and Paul Wootton, Washington representative.

JANUARY, 1942

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Construction Methods

A Pictorial Survey of Current Practice, Equipment and Materials

JOHN ABBINK, Publisher

ROBERT K. TOMLIN, Editor

A. E. PAXTON, Manager

Editorial Staff: Vincent B. Smith, Paul Wootton (Washington)

N. A. Bowers (San Francisco) Nelle Fitzgerald

A McGRAW-HILL

PUBLICATION

The HOW of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

- How **IMPROVISED SWING PONTOON BRIDGE** was installed for temporary service of pedestrian traffic. —p. 39
- How **62-ACRE BUILDING** was constructed for bomber assembly plant. —p. 42
- How **SHOP-FABRICATED TRUSS** for 150-ft. bay of aircraft building was erected in two parts. —p. 44
- How **WELL POINTS** predrained trench for storm trunk sewer. —p. 44
- How **SAND-LIME BACKUP BRICK** were tied with headers in every fourth course of wall construction. —p. 45
- How **NEEDLE-BEAMS** served in underpinning columns of industrial building. —p. 46
- How **PLYWOOD TEMPLATES** perforated to pipe sizes hold conduits in position for concreting at columns. —p. 47
- How **PUMPED CONCRETE** was delivered through pipe lines to 20 acres of army warehouse floor area. —p. 48
- How **VACUUM MATS** removed excess water from concrete and facilitated finishing of floor slabs of warehouse. —p. 50
- How **SHATTERPROOF WINDOWS** of flexible acetate were installed in buildings in England. —p. 51
- How **HORIZONTAL SINGLE-WALL DESIGN** expedited site assembly for defense housing. —p. 52
- How **LIGHT-WEIGHT WALL PANELS**, mill-cut to exact size, were set and nailed by hand on housing project. —p. 52
- How **COMPOSITE ROOFING BOARD** was installed with aid of interlocking feature. —p. 53
- How **ROOF TRUSSES** were assembled on jig table for defense housing project. —p. 53
- How **BLOCK-SQUARE GARAGE** was built in pit 48 ft. deep. —p. 55
- How **MOBILE WORKING SCAFFOLD** was mounted on skids for lowering by tractor to new locations on building job. —p. 56
- How **MELTING ICE CAKES** lowered 30-in. water supply pipe line without interrupting service. —p. 57
- How **GLASS BEADS** were applied to increase visibility of traffic lines. —p. 57
- How **SANDBLASTING** cleaned surface of concrete in dam prior to next pour. —p. 57
- How **TUNNEL MUCKING** is done with modern methods and equipment. —p. 58
- How **SWITCHING DEVICES** of several types pass muck cars in tunnel. —p. 63
- How **TRACTOR** was rigged to carry pipe for oil on steep grades. —p. 70

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What Can I Do?

EVER SINCE that Sunday morning when havoc swooped from the skies upon Honolulu, a new question has been churning about in millions of American minds. It is this: What can I do to help my country win this war?

This insistent question has pushed aside all matters of personal interest. From now on, individual wants and wishes must give way to the paramount needs of the nation. We all accept that. We have undertaken a huge job. Or, I should say, we have had a huge job thrust upon us. And unless we see that job through successfully it won't much matter what any of us may want.

That job is to win this war.

No longer are we trying to prepare for a war that we may get into. Today we are trying to win a war we're already in—and in up to our eyes. Nothing that any one of us now can do to help himself can get him very much if it does not also help our country to win this war.

I am sure that those who read these words will find many things to do. Some will enlist in the armed services. Some will become active in civilian defense. Some will labor to relieve distress in their home towns. Some will work with organizations set up to serve the men at the front. Each can and will find something he can do.

But this insistent question "What can I do?" goes beyond the individual and his personal service. It reaches through the offices and the shops of every American business concern. And what I have to say here is not directed toward individual effort. Rather is it intended for the men and women of American industry who make that industry a living part of American life. Today they are asking themselves: What can industry do? Or better still, what must industry do if our country is to finish the job it has started?

Those of us who work in and with American industry have one supreme obligation. We may feel very patriotic; we may be willing to serve "in any capacity," we may be willing to sacrifice . . . if necessary. But if we fail to meet that one obligation, we shall fail our country in its time of need.

THAT SUPREME OBLIGATION IS AN HONEST DAY'S WORK, EVERY DAY, FROM EVERY MAN, EVERY WOMAN, EVERY MACHINE.

IT IS AS SIMPLE AS THAT!

And that goes for all of us, whether we are engaged in civilian production or working directly on the weapons of war. American victory can be won only through the productivity of American industry.

Efficiency in production is not the responsibility of a few. It can be achieved only as we all put to useful purpose every minute of our time, every ounce of our energy, and every pound of our materials.

This responsibility of industry is the more vital because of what has happened to the business of making war. There was a time when success in war was chiefly a matter of well-trained, well-disciplined armies and competent leaders—when men were everything. In those days, military strength was a matter of strong battalions and able generals. Both still are vital. But today military might is essentially mechanical might. Modern war is an industry just as much as a factory or a railroad. In the first World War, mechanical equipment was relatively simple and limited. But today the special equipment of war and the expert skill needed to use it spell the difference between victory and defeat.

We Americans are not expert war makers. That is why we must expect to suffer grievous losses before we can win substantial gains. We do not have military training and experience ready to hand when we need them. Neither do we have, ready for action,

enough of the machines that are so essential to modern warfare.

So, when it becomes necessary to fight for our lives, we must start from scratch. And today, after a year's effort, we still are not ready to trade blow for blow with enemies who for years have schooled their leaders, trained and disciplined their people, and organized their industries to make war. We shall need more time to develop our strength. And while we are doing that, we must expect reverses.

But there is a brighter side to all this. For it follows that if we are granted this all important time, the change in the method of warfare is right down our alley. The greater importance of mechanized equipment plays straight into the hand of the world's greatest industrial nation . . . if there is one thing America does know, it is industrial production! Our industries know how to produce. They have the skilled manpower. They have the organized facilities. Beyond any doubt, we can produce all that we need to win the victory that we must win—if only we are given the time.

THE FIRST RESPONSIBILITY OF THE ARMED FORCES IS TO GAIN THAT TIME FOR US.

THE FIRST RESPONSIBILITY OF INDUSTRY IS TO USE TO THE FULL EVERY SECOND OF THAT TIME IN PRODUCING THE WEAPONS THE ARMED FORCES NEED TO WIN THE ULTIMATE VICTORY. INDUSTRIAL PRODUCTION IS THE KEY TO VICTORY. BUT IT MUST BE BIGGER PRODUCTION AND FASTER PRODUCTION THAN WE EVER HAVE KNOWN.

Heretofore American industry has worked to produce more of those things which make our lives more enjoyable. Today it must divert much of its energy from the products of peace to the weapons of war.

This change sets up a new yardstick of industrial performance. In time of peace we measure production efficiency in terms of money saved. From now on, we must measure efficiency chiefly in terms of time saved. For the plane, the tank, the gun, or the ship that is ready when it is needed to win a victory, is worth a million times more than the one that is delivered too late to avert a defeat.

Everyone knows how short we are of some materials and machines. But our most tragic shortage is the shortage of time. So whatever we may waste in the days ahead—and unhappily we are bound to waste plenty—let us never forget that the most deadly waste of all is the waste of time.

Time wasted never can be replaced. No one ever has discovered a substitute for time. If we would avoid the waste of this irreplaceable ingredient of victory, we must use every minute of it effectively—while we still have it.

That goes for us all. It goes for the man or the woman at the bench, at the desk, at the counter, in the field, or in the executive office. It goes for the politician as well as for the business man. It goes for the humblest and the most powerful. A nation at war cannot carry deadheads. It cannot spare a square foot for any one who will not pull his weight.

In this war, nothing short of complete victory can save the liberties of us all, rich and poor, employer and employee, haves and have-nots alike. The price of that victory is the labor, the loyalty, and the devotion of every last one of us. Winston Churchill said it well for the British people. You know how he said it. I need not repeat it.

All this imposes upon American industry, its owners, its managers, and its workers, the gravest responsibility they ever have assumed. If our country is

to survive as a free nation, American industry must rise to that responsibility. If our country should fall, it would fall because American industry fell short of the need. It would be another case of "too little and too late."

This grave responsibility calls for the keenest management industry ever has known. It calls for unremitting research to make the most of our resources. It calls for the reduction of waste to a record minimum: that goes for waste of time, labor, and material. It calls for keeping our machinery working as near to full capacity as we can contrive. It calls for the highest rates of unit production we ever have known. That will mean skillful coordination by management and the most intelligent cooperation that the men in the shops can give. It calls for inventive ingenuity to match that of a nation which has produced some of the world's outstanding technical genius. For this is a war of technical proficiency.

But above all, it calls for a new devotion to the day's work. For so long as we are at war, the day's work will determine our country's security.

Whatever may be our material resources and our technical skill, however resourceful our management, however broad the scale of our effort, industry cannot measure up to its prodigious responsibility if any of us shirk the day's work. Right there is where we find the one thing we all can do—the one thing that is within the power of each of us.

THAT ONE THING IS SIMPLY TO DELIVER AN HONEST DAY'S WORK WHEREVER WE ARE CALLED TO SERVE. HONEST WORK WILL WIN THIS WAR. LOAFING WILL LOSE IT. THE SHOWDOWN WILL BE WHETHER HITLER CAN DRIVE HIS PEOPLE TO WORK HARDER THAN WE ARE WILLING TO WORK. THERE IS NO ONE TO DRIVE US. WE MUST DRIVE OURSELVES!

Is that so much to ask? It is all our country asks of us, the men of industry. It is all that the men who must work the guns and tanks in the field ask of us. It is all that the men who work our ships and our planes ask of us. "Give us the planes, the guns, the ships, the tanks, and all the rest of our tools," they tell us, "and we'll give you the victory that means so much to us all. But, in the name of that victory, give them to us quickly—QUICKLY—QUICKLY!"

Is that, I repeat, too much to ask of us?

To help American industry achieve ever-higher standards of efficiency has been the traditional mission of McGraw-Hill for three-quarters of a century. Normally that effort has been directed toward higher efficiency in the business of peace. But, as in the first World War, twenty-five years ago, it now is directed toward efficiency in the business of war and in every department of American effort that can contribute, directly or indirectly, to the achievement of victory.

And to that mission, I here pledge every resource of this company, its publications, its books, its staff, and every service it is qualified by experience and training to render to American industry, now enlisted in our common cause.

That is what we of McGraw-Hill can do. And that is what we shall do to our utmost.

James H. McGraw, Jr.
President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.



'INCOR' SAVED 2½ WEEKS ON AIR-CAMERA PLANT ADDITION

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WITH last-winter temperatures as low as 9° above zero, concreting proceeded at normal speed on 4-story addition to Fairchild Aviation Corporation's factory, Jamaica, N. Y. With adequate heat protection, economical 'Incor' concrete mixes permitted safe stripping in 2 to 3 days. 'Incor' saved a total of 2½ weeks.

Use 'Incor'* this winter . . . maintain high speed needed for national defense . . . reduce freezing risk . . . save 2 or 3 days' heat protection on each pour . . . cut form costs in half. Get dependable high early strength plus long-time durability proved by 15 years' outstanding performance. Write for copy of "Cold-Weather Concreting." Lone Star Cement Corporation, Room 2261, 342 Madison Avenue, New York.

*Reg. U. S. Pat. Off.



Addition to Fairchild Aviation Corporation Factory, Jamaica, N. Y. Architect: Electus D. Litchfield, New York. Contractor: White Construction Co., New York.

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"TIME IS SHORT." So reads the sober reminder posted in a thousand busy defense plants from coast to coast. Engineers and contractors on defense work don't need to be told. They've been giving time a licking ever since America began to prepare.

Now they've got a new ally in their battle. Already the "Caterpillar" Diesel DW-10 Tractor is speeding up defense on a growing list of jobs.

Designed and built from the ground up for long, fast, heavy hauling, this unit is doing all that was expected of it, and more! It has the husky, economical power of a 98-hp. "Caterpillar" Diesel Engine. "Finger-tip" steering. "High-traction" differential. Short turning radius. Full floating seat. Heavy-duty constant mesh transmission. Five speeds forward. High clearance. Scientific weight distribution that gives super-traction for every use.

The "Caterpillar" Diesel DW-10 Tractor is

amply powered to handle a big payload at 18 miles an hour. And it has all the advantages of simple, rugged, dependable "Caterpillar" construction, through and through.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

★ **FOR VICTORY**—Our armed forces have first call on "Caterpillar" production. We thank customers who have suffered delivery delays by giving clear right-of-way to our Victory efforts.

Some of the defense jobs where "Caterpillar" Diesel DW-10 Tractors are setting records for speed and economy are:

Fort Worth Bomber Plant, 4 units; Twin City Ordnance Plant, 10 units; Mississippi Ordnance Plant, 10 units; Lauderdale Airport, Mississippi, 4 units; Bermuda Base Construction, 16 units; Merced Airport, California, 3 units; Denver-Cheyenne Defense Highway, 3 units; Des Moines Arms Plant, 8 units.



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ENGINES AND ELECTRIC SETS
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Diesel

FOR THE DEFENSE JOBS!



↑ Here's the "Caterpillar" Diesel DW-10 Tractor pulling "Caterpillar"-built W-10 Wagon, with capacity of 11 cu. yds., heaped measure.

← This "Caterpillar" Diesel DW-10 Tractor is pulling a LeTourneau Carryall scraper.

→ The new "Caterpillar" Diesel DW-10 Tractor with LaPlant-Choate scraper moving earth on an airport job.





DEFENSE DRIVE

bans unnecessary shut-downs. Proper lubrication prevents forced lay-offs. For **CONSTRUCTION EQUIPMENT** there are . . .

. . . SINCLAIR SPECIALIZED OILS and GREASES

to meet and handle the grueling demands on heavily loaded machinery. Try these lubricants for top yield of continuous service hours. Full details, or lubrication counsel, promptly obtained by writing nearest Sinclair office or Sinclair Refining Company, 630 Fifth Ave., New York, N. Y.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



EQUIPMENT of R. B. Potashnick, Cape Girardeau, Mo., working on highway project near Cache, Ill. Sinclair lubricants and fuel used.

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LET EXTRACTION TESTS TELL THE STORY



ACCURATE GRADATION

ACCURATE PROPORTIONING

THOROUGH MIXING

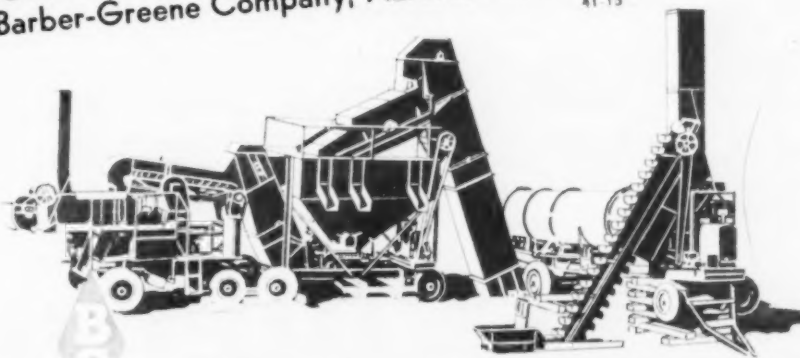
CONSISTENT PERFORMANCE

SIMPLE INSPECTION

Many who completely understand the fundamental principles of the Barber-Greene Mixer logically wonder if it is possible for the results to be as good as the theory. They know that the aggregate feeder is calibrated by weight, on the job; that each size of aggregate is continuously, but separately fed into the pugmill. They know that the bitumen metering pump and the aggregate feeder are mechanically interlocked to deliver a constant ratio, and that the materials are fed in a small continuous stream, giving a practically uniform distribution at the start of the mixing. But with such revolutionary advantages they want to see the final proof. Job after job has produced this proof. Laboratory analyses of samples from the discharge of the pugmill, and core samples from the finished course prove the highest accuracy of proportioning, the finest homogeneity.

You owe yourself a complete understanding of the principles and results of what is truly TOMORROW'S MIXER TODAY. Write for literature, there is no obligation. Barber-Greene Company, Aurora, Illinois.

41-15



BARBER - GREENE



ADDITION TO GRAIN ELEVATOR

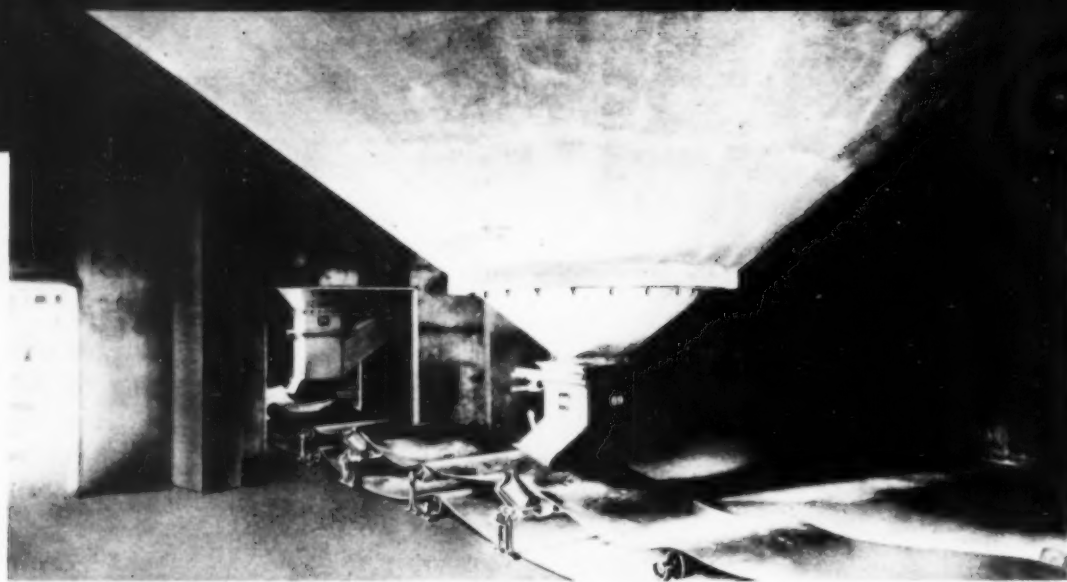
OWNER: Standard Milling Co., Buffalo, N. Y.

CONTRACTOR: McKenzie-Hague Co., Chicago, Ill.

CONCRETE'S

A GREAT PINCH-HITTER

THESE DAYS



One thing about times like these, they sure make folks resourceful. Can't get steel, for instance? O. K., why not use concrete?

The 35 tank hoppers in the 2,000,000-bushel addition to this Buffalo grain elevator were to have been made of steel; but because of urgent defense needs, steel was not available. So, the hoppers were made, instead, of concrete; and, to speed the work, the concrete was made of Lehigh Early Strength Cement. That way, they got concrete that cured to

service strength 3 to 5 times faster than if normal cement had been used.

Concrete construction vital to defense; private construction that might be held up through priorities on other materials—this work can be pushed to rapid completion by the use of quick-service concrete made with Lehigh Early Strength Cement. Not only will its use often reduce construction costs, but a denser, better concrete will result.

Ask the Lehigh Service Department for further information.

Lehigh

EARLY STRENGTH CEMENT

for **service-strength** concrete in a **hurry!**

LEHIGH PORTLAND CEMENT COMPANY • ALLENTOWN, PA. • CHICAGO, ILL. • SPOKANE, WASH.

Two Years' Proof-



Loading excess earth on road grading operations with Mobiloader and "Caterpillar" D4 Tractor at air base in Colorado.

that the Athey
MOBILOADER
Successfully
Digs Toughest
Materials ...
Cuts Loading
Time and Costs



The city of Janesville, Wisconsin keeps its Mobiloader busy on numerous jobs, uses it here in building new subdivision.



500 tons of gold ore per ten-hour day are loaded into trucks by this W4 Mobiloader in Colorado.

**POWERED BY "CATERPILLAR" D4 TRACTOR—
HAS 1 1/8 CU. YDS. CAPACITY—ECONOMICALLY
HANDLES ALL TYPES OF MATERIALS**

Two years ago, Athey introduced a revolutionary kind of machine for moving materials—the Mobiloader. Unloading its load overhead, experimental machines were placed on various jobs for close study and research. *During those two years, the Athey Mobiloader has proved itself!* Today, from coast to coast, and in many foreign countries, owners are using Mobiloaders in a wide variety of applications, in all kinds of materials.

The design of the Mobiloader permits faster production and lower costs on scores of different loading operations. Weight is distributed over entire track area of tractor which gives maximum crowding action for digging toughest materials. This means bigger loads with less horsepower.

By digging at the front and dumping at the rear, speedier output is assured. There's no turning of the tractor to cause excess wear on tractor parts. There are many savings to be had with a Mobiloader on your job. Find out *now* what this money-saving machine can do—send the coupon today for descriptive folder. Athey Truss Wheel Co., 5631 W. 65th Street, Chicago, Illinois.

ATHEY

MAIL COUPON TODAY

Athey Truss Wheel Co.,
5631 W. 65th Street,
Chicago, Ill.

Please send me, without obligation, the new Mobiloader folder showing many pictures and facts about loading.

Signed _____

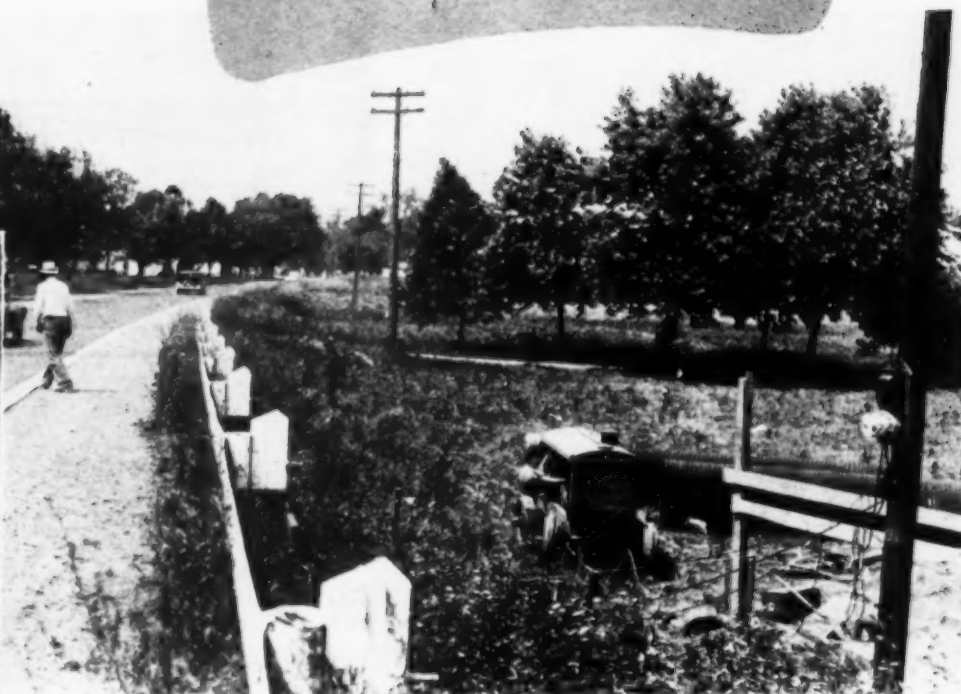
Street _____

City _____

CM-1-42

**THEY SNEAKED
IT THROUGH...**

*and "Traffic
Never Knew!"*



ABOVE: Traffic rolled over this busy highway undisturbed while the ARMCO Pipe was being jacked beneath. It saved time and money and gave traffic a break!

AT LEFT: Football fans would call this "a quarterback sneak." Engineers and contractors agree that pipe-jacking is a touchdown play, with savings the goal.

No pavement destroyed . . . no traffic hold-ups. The contractor simply "sneaked" this pipe through by the ARMCO-perfected pipe-jacking method. The busy highway was not disturbed and the job went right ahead!

This is just one way that ARMCO Corrugated Metal Pipe saves valuable hours and dollars on drainage jobs. Unskilled men easily handle the long shop-fabricated sections without special tools. Tight joints are assured by sturdy band couplers that go on quickly and smoothly. The work moves fast and costs are low.

When it is in the ground,
ARMCO Pipe is ready for a long,

long stay. The flexible corrugated metal design provides ample strength to withstand crushing weight and the pounding of heavy traffic. Durable ARMCO Ingot Iron has proved itself an excellent underground metal. Where erosion threatens, the bottom of ARMCO Pipe is protected by a thick bituminous pavement. A full coating of this same special material guards against corrosion.

Use ARMCO Paved Pipe wherever speed, strength and durability are important. It saves installation and maintenance dollars. Write us; we'll gladly tell you the whole story. THE ARMCO DRAINAGE PRODUCTS ASSOCIATION, 55 Curtis Street, Middletown, Ohio.



ARMCO PAVED INVERT PIPE

Reach

WHEN YOU NEED IT!

THE Northwest "feather-touch" Clutch Control—Uniform Pressure Swing Clutches—and various combinations of boom hoists and auxiliary drums makes long boom work smoother, easier and quicker. Northwests get things done and that's what counts today! There is a Northwest Crane, Shovel or Dragline for every job. 18 sizes, $\frac{3}{8}$ yd. capacity and larger. It will pay to plan ahead for a Northwest.

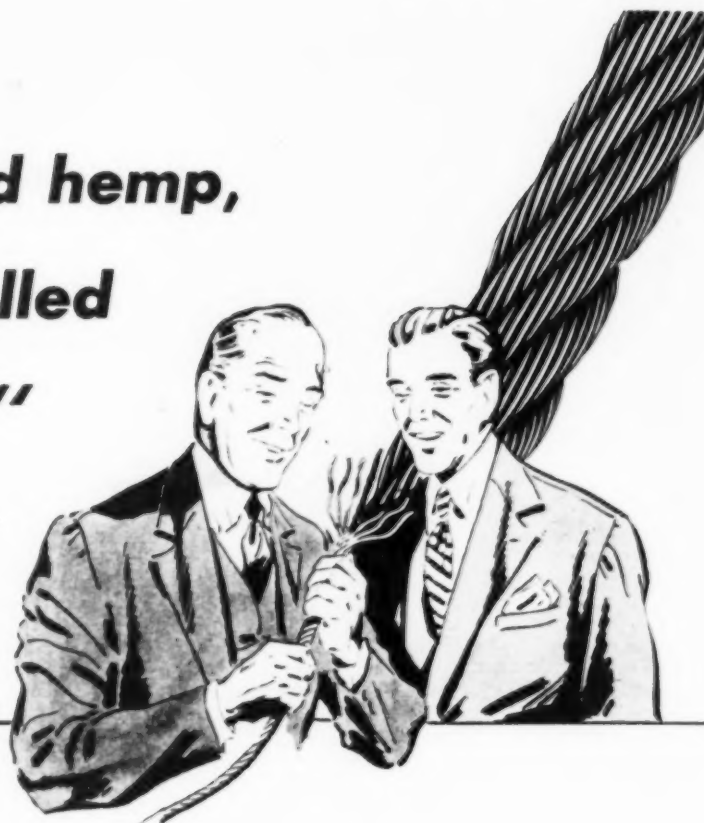
**NORTHWEST
ENGINEERING COMPANY**
1728 Steger Building
28 East Jackson Blvd.
Chicago, Illinois



NORTHWEST

Built
in a range of
18 sizes— $4\frac{1}{2}$ to
40 tons capacity

**"You put in steel, and hemp,
and something called
Experience ..."**



**It's something only time
and tasks can bring**

"Make all the tests you want of wire rope samples. Pull them apart, into steel and hemp, and still you'll never find the quality that's paramount. The makers' experience... *knowing how*."

Our experience here at Roebling has two dimensions. You can count it on the map or on the calendar. You can see it working from the ingot to the finished reel.

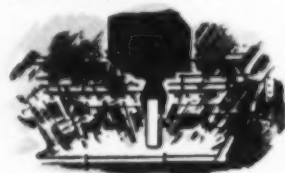


When Doctor Beebe's Bathysphere sank down into the ocean's depths, a full half mile, his lifeline back to sunlight was a single length of Roebling "Blue Center" Wire Rope. When the builders of Mud Mountain Dam, Enumclaw, Washington, built a 35,000 pound tent that would cover half a city block, to protect

their fill, Roebling Wire Rope was chosen to support its immensity, to hold against wind and rain.



Equipping the world's largest power shovel... building the Golden Gate and George Washington bridges... lifting lives from the world's deepest mine... Roebling is both the teacher and the pupil, whenever we tackle such a job. All across the country, on its lakes and oceans, Roebling's learning every day ways to make "Blue Center" better than before. Experience...



As Roebling field men learn from rope at work, new generations here at Tren-

ton are learning secrets from the old. Father is teaching son how to tell when an ingot is ready to leave the soaking pit, to be kneaded into Roebling billets. Roebling engineers are learning more and more of wire rope's jobs, and how to meet them to a 'T'.

Roebling research is uncovering brand new facts that will make this trade mark mean even more to-morrow...



Experience of men in the Roebling mills, of Roebling men in the field... Roebling process control, and engineering, and research... there's many a hidden ingredient in "Blue Center" Wire Rope. Reasons why it lives so long, and never fails to deliver its full measure of service.

JOHN A. ROEBLING'S SONS COMPANY

TRENTON, NEW JERSEY

Branches in Principal Cities



THAT'S THE ONLY WAY TO MAKE

ROEBLING

"Blue Center"

STEEL WIRE ROPE

PREFORMED OR NON-PREFORMED

"HIGH DUMP" TRUCK MIXERS

Solve Your Placing Problems



INTO HOPPERS

OVER DIRT PILES INTO THE FORMS

FASTEST LOADING, FASTEST MIXING AND FASTEST HIGH DISCHARGING TRUCK MIXER ON THE MARKET . . .

Let us show you how these mobile, flexible mixing plants, with their faster "One-Shot" Top Loading, 2-Speed Mixing and Vacuum Controlled Discharge can increase your yardage, cut your placing costs. Out-sell all others. Built in 2, 3, 4, 5 yd. sizes — also Combination Top or End Loaders, if desired.

THE JAEGER MACHINE CO., 800 Dublin Ave., Columbus, Ohio

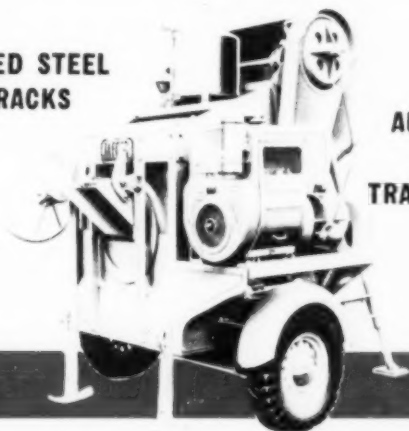


Standard "LOW CHARGE" Models in 2 to 8 Cu. Yd. Sizes.

Jaeger Portable Hoppers Save Waiting on Job!

MACHINED STEEL DRUM TRACKS

AUTOMOTIVE TYPE TRANSMISSION



Built to MIX FASTER RUN SMOOTHER, QUIETER, LONGER



3 1/2 S with Measuring Batch Hopper



14S 90" Skip

Put a Jaeger on the job and get those profits slower mixers can't produce. Load faster with Automatic Skip Shaker, mix more thoroly with Criss-Cross Action, discharge faster than any other mixer on market. Drums roll on machined tracks, chilled ball bearing rollers.

Transmission runs in oil. All sizes trail easily on Timken bearings and pneumatic tires.

Send for Catalog, Compare Prices

THE JAEGER MACHINE CO.
800 Dublin Avenue, Columbus, Ohio
World's Biggest Manufacturer of Concrete Mixers, All Types, Sizes to 56 S.

JAEGER SPEEDLINE

... CONTRACTORS WHO LOOK AHEAD are buying JAEGER PUMPS

The surest protection your money can buy against pump breakdowns and job delays . . .

— the best insurance a contractor can have against the cost and uncertainty of early replacement!



"3 TIMES FASTER PRIMING saved my shirt on pier hole excavation."



"AFTER 4 YEARS, my Jaeger is still going strong."



"EVERY UNIT FACTORY TESTED AND CERTIFIED — I can depend on Jaeger performance."



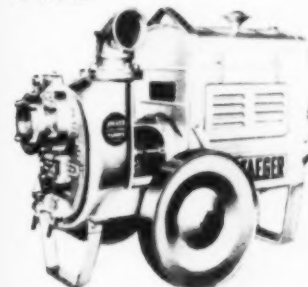
"MY JAEGER SURE-PRIMES HAVE EVERYTHING — Replaceable Liner Plates to save me money, a Seal I can inspect any time in 30 seconds, a Shell that really cleans itself."



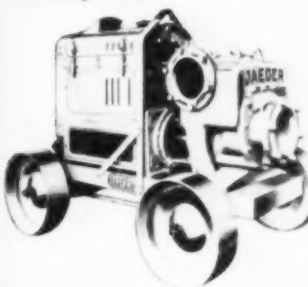
"I CAN GET JAEGER SERVICE OR PARTS WHENEVER AND WHEREVER I NEED 'EM."



"SURE-PRIME" HEAVY DUTY SMALL PUMPS: 2" and 3" units that stand high pressures, continuous pumping — many thousands of hours.



"SURE-PRIME" PORTABLE 4" AND 6" PUMPS: Capacities to 90,000 G. P. H. in compact, easy handling units.



"SURE-PRIME" BIG CAPACITY PUMPS: 8" and 10" sizes (125,000 to over 200,000 G. P. H.) — most portable of big pumps.

THE JAEGER MACHINE COMPANY

800 DUBLIN AVENUE, COLUMBUS, OHIO

World's Largest Manufacturer of Contractors' Pumps — Mixers, Hoists, Towers, Truck Mixers, Concrete and Bituminous Paving Equipment.



“Any Color... just so it's red...”

... and another way to say it is... “Any powder just so it's ‘Forty percent’”

RED, of course, is a perfectly good color — and “Forty percent” is fine, too. But the contractor who uses only one explosive, under any and all circumstances, is in the same boat with the housewife with a one-color mind. He's missing a lot.

More than 75 Atlas grades were used on construction work last year. Each has an

individuality that makes it *the* grade for best results under certain conditions.

Naturally, busy contractors can't take time to learn the properties of all these grades, or to learn where and when each should be used. That's a job for a specialist — your Atlas Technical Sales Representative. Knowing the entire line well, he can advise you which grade should give you most for your money on any given job.

You'll find a consultation profitable.

ATLAS

EXPLOSIVES

“Everything for Blasting”



ATLAS POWDER COMPANY, Wilmington, Del. • Offices in principal cities • Cable Address—Atpowco

Setting a Pace



FOR Two 34-E PAVERS

at FORT KNOX, Kentucky



BUILDING finegrade ahead of two Single Drum 34-E Pavers is a job that demands speed and more speed, but the R-B Power Finegrader illustrated here is doing that in its stride. It's leading the parade with a clean, smooth accurate grade well out ahead of the pavers. The job is at Fort Knox, Ky., with the Breslin Construction Co., Louisville, and White Consolidated, Inc., Chicago, putting in 245,000 sq. yds.

of 11, 22, 33, and 44 ft. roads—all finegrading done by Buckeye R-B machines. On hundreds of similar paving jobs—roads, airport runways, proving grounds — Buckeye R-B Power Finegraders are cutting the grade right on the payline, saving time, money and material. You'll profit by putting Buckeye R-B Finegraders on your paving jobs. Write for new Bulletin Today!

BUCKEYE TRACTION DITCHER COMPANY, Findlay, Ohio

Built by Buckeye

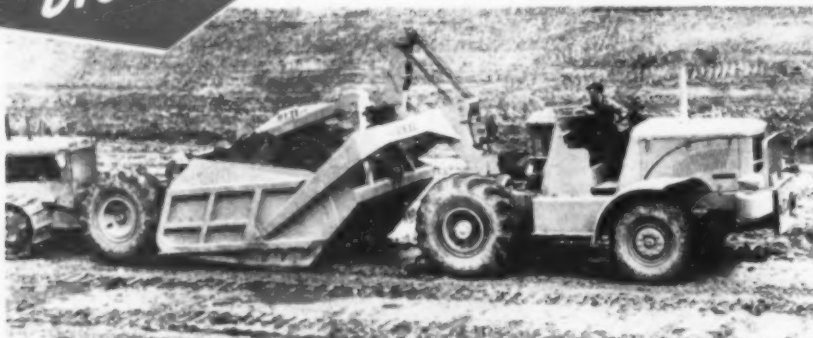
CONVERTIBLE SHOVELS, TRENCHERS AND BACKFILLERS, TRACTOR EQUIPMENT, R-B FINEGRADERS, ROAD WIDENERS AND SPREADERS



Announcing HEIL HI-SPEED

FASTER DIGGING

Push-loaded with a crawler-type tractor, the Heil Hi-Speed Cable Scoop digs a heaping 15-yard load in 40 to 50 seconds.



FASTER HAULING

Away to the fill at travel speeds of 6 to 20 M.P.H., depending on road conditions, goes the 15-yard Heil Hi-Speed Scoop.



FASTER SPREADING

Positive mechanical unloading is accomplished by the Heil tilting floor pushout. Leverage action insures low line-pull.



Heil Tractor-Scraper Combination Gives You Profitable High Speed Dirtmoving at New Low Cost Per Yard!

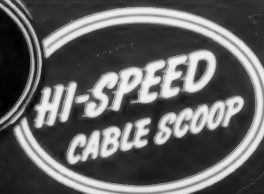
The Heil Hi-Speed Cable Scoop combines the proven efficiency of the Heil Twin-Cable Scoop with the speed, economy and flexibility of the rubber tired diesel powered Heil Hi-Speed Tractor.

Push-loaded with a crawler tractor — this unit digs a heaped 15-yard load in 40 to 50 seconds — and speeds away to the fill at travel speeds of 6 to 20 M.P.H. depending on road and grade conditions. Faster operation, greater efficiency and lower maintenance costs permit the Heil Hi-Speed combination to show profits on jobs where slower crawler-scraper operations would not be practical.

Compare the working advantages and specifications of this job-tested Heil Hi-Speed Unit with any other method of dirtmoving and see for yourself why the Heil Hi-Speed combination offers more for your money in efficient, profitable operation and low maintenance costs.

SPECIFICATIONS AND OPERATING ADVANTAGES

HEIL HI-SPEED TRACTOR — Four wheel tractor design assures stability and safety. *Hydraulic Power Steer.* Oversize brakes on Tractor drive wheels and on Scoop trailer wheels are operated by foot pedal. Individual hand control brakes on Tractor drive wheels give short turning radius. 150 H.P. Cummins Diesel engine.



THE

ing the New CABLE SCOOP!



Heil Hi-Speed Tractor turns and maneuvers easily. Hydraulic steer makes turning effortless, even over rough ground. Driver has clear, unobstructed vision at all times.

(Standard). Gasoline engine or other Diesel engines are available. 21 Inch American Blower Fluid Coupling Drive insures smooth operation and reduces gear shifting time to a minimum. Heavy duty double reduction rear axle.

HEIL HI-SPEED SCOOP—15 Cubic Yard Capacity. Heil Hi-Speed Scoop has same operating features as four-wheel Heil Twin-Cable Scoop — Easier loading, bigger top loads, faster unloading, low line pull and lower cable replacement costs. Tires on Scoop and tires on Tractor drive wheels are interchangeable. Spring-cushioned push bumper furnished as standard equipment.

Decide now to investigate the profit-making features of the new Heil Hi-Speed Cable Scoop. Write, wire or phone for complete details, today.



Large diameter pneumatic tires give ample traction and flotation. Oversize brakes are arranged for individual or unit control. Power control unit is direct connected to the engine and operates independent of the tractor transmission.

HEIL CO.

MILWAUKEE, WISCONSIN • HILLSIDE, NEW JERSEY

YES...! IN EVERY INDUSTRY LUBRIPLATE SPEEDS DEFENSE



On land—on sea—in the air—in every phase of industry vital to defense. LUBRIPLATE lubricants are doing jobs that are nothing short of amazing. From a smear on the worm screw of the naval officer's binoculars to a ton of LUBRIPLATE in the dredge underwater gear case—against friction and wear—thwarting rust and corrosion—conserving bearings and parts—LUBRIPLATE carries on.

In spite of heat and high water—tractors and trucks rolling through muck and mud—spotless food packing machines constantly washed with scalding water—textile spindles whirling faster than ever before—marine equipment exposed to highly corrosive seawater and spray—LUBRIPLATE lubricants perform under conditions that would stop ordinary lubricants cold.

LUBRIPLATE DIVISION FISKE BROTHERS REFINING COMPANY

SINCE 1870

Newark, N. J.

Toledo, Ohio

DEALERS FROM COAST TO COAST

LUBRIPLATE

THE MODERN LUBRICANT that Arrests Progressive wear



"It's the Film"



Now, more than Ever WAREHOUSES BY PIPELINE!

Concrete is pumped in place by two Rex Pumpcretes on the floors for a new United States Quartermaster's depot—a job entailing 52,000 cu. yds. of Pumpcrete-pumped concrete!



WE have always said that the Rex Pumpcrete was a "natural" for most concrete jobs—because it simplifies the job of placing concrete in difficult form work—because Pumpcrete permits a snappier, more orderly job progress—because Pumpcrete saves the money and time formerly spent in erecting and operating buggy runs, chutes, hoists, towers and other old-fashioned equipment.

Today, speed is important—and speedy placement of concrete is one of Pumpcrete's biggest advantages—placing on many jobs up to 65 cu. yds. per hour with one machine.

Before you bid on any defense contract, take a look at Pumpcrete. See it first in the book, "Why and Where to Pump Your Concrete." To get your copy, simply write 1664 W. Bruce Street, Milwaukee, Wisconsin.



PUMPCRETE

THE PUMP THAT PUMPS CONCRETE

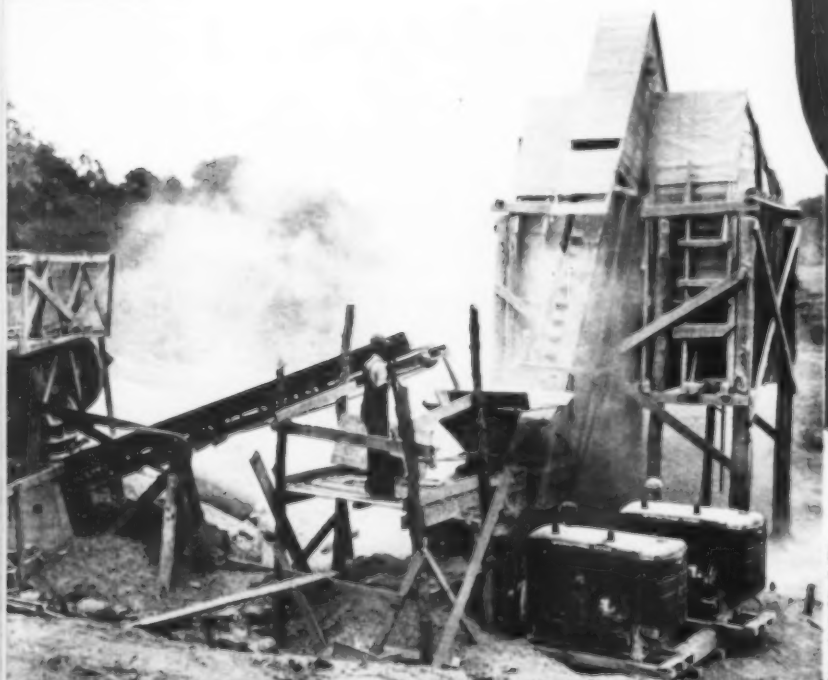
Sizes for Pumping from 15 to 65 cu. yds. per hour

C H A I N B E L T C O M P A N Y O F M I L W A U K E E



Carving a new road through mining property in Utah, with an International TD-18 Diesel TracTracTor, equipped with bullgrader.

Two International UD-18 Diesel Power Units operating lime crushing outfit near Kirksville, Mo. An economical pair of engines—with stamina and dependability for a variety of jobs.



IN THESE TIMES LET'S FACE THE FACTS

THESE are *different* times than any of us have experienced. Your business will *not* be "as usual." NATIONAL DEFENSE takes precedence over all else. In such times all must face facts with *common* sense for a mutual solution of the problems of today.

One fact to be faced is this: there may not be enough new machines to go around. International Harvester will do its best to provide its customers with as much new machinery as possible. But plans laid today must be flexible enough to meet tomorrow's situation.

In such a time users can appreciate what International QUALITY and International SERVICE mean. International TracTracTors, Wheel Tractors, and Power Units are having to work harder and live longer. They're doing just that, because they are *designed* and *built* for the long pull ahead. A broad background of manufac-

Below: Putting a new angle on a road grade with an International-powered grader. The engine is an International UD-14 Diesel.



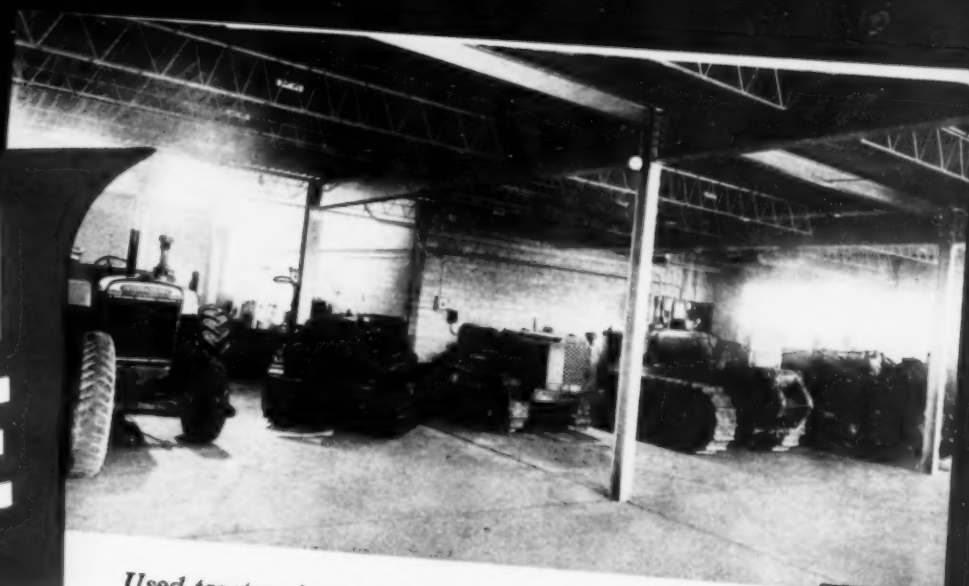
INTERNATIONAL

WITH COMMON SENSE

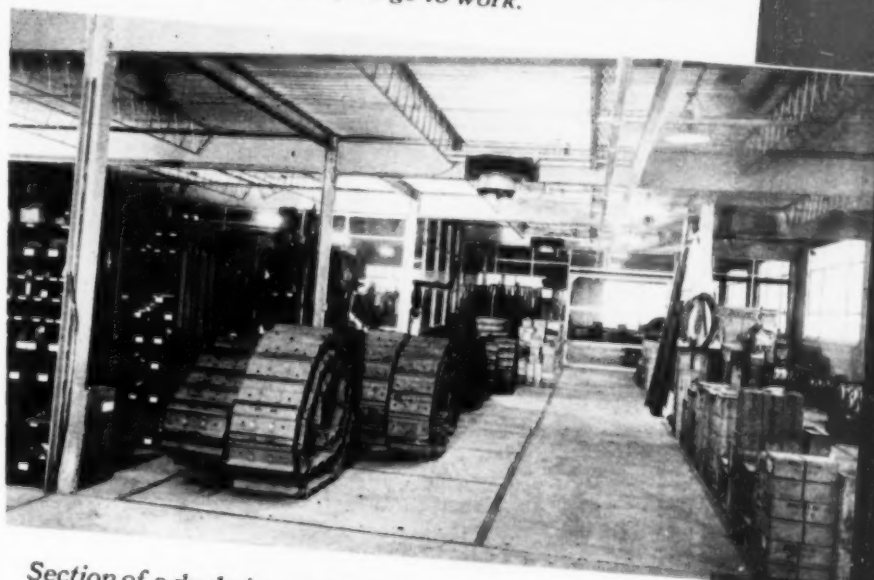
turing, engineering, and metallurgical experience stands behind every tractor and engine carrying the International nameplate. International equipment is *proved all ways for come what may!*

But even the best machines need a regular program of servicing, preventive maintenance, and overhaul. Arrange with the International Industrial Power dealer for tractor and engine service and check-ups regularly. He is equipped to do a service job as never before, to help you prolong the useful life of your equipment. His service facilities, trained servicemen, and stocks of genuine IHC Parts are at your command . . . backed by 85 Company branches coast to coast.

INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago, Illinois



Used tractors in an International Industrial Power dealer's showroom, all thoroughly reconditioned and ready to go to work.



Section of a dealer's parts department devoted to such large, heavy parts as tractor tracks, sprockets, etc.



A dealer's main service shop and assembly floor. Note convenient unloading dock in foreground.

INTERNATIONAL HARVESTER Builds for Defense

Crawler-Type Tractors
Motor Trucks
37 and 75 mm. Shells
Intermediate Caliber Artillery
High-Speeding 155 mm. Gun Carriages
Packing Stays for Shell Containers
Derikon Anti-Aircraft Gun Mounts
Anti-Tank Gun Carriages
Refrigeration Equipment for Army Camps

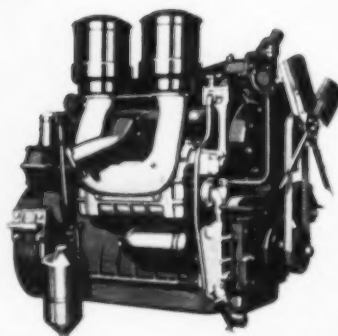
Industrial Power



BY EVERY STANDARD—THE STRONGEST PULLERS YOU CAN BUY!

● Every man and every machine has more work to do in 1942. Power in trucks becomes more important than ever. And the *strongest* trucks you can buy are GMCs, in every engine size. General Motors Trucks give you *highest maximum torque* per inch of piston displacement. They develop their *greatest pulling power* at *usable* engine speeds. And they deliver their full rated horsepower well within top governed speeds. By every standard, you get the edge in performance with GMCs. And remember, GMC Trucks for every hauling job are priced right down with the lowest in the industry.

Page 26—CONSTRUCTION METHODS—January 1942



For pull-ability and fuel economy that can't be matched, GMC offers a full line of Diesel-powered trucks in capacities from 3 to 20 tons. Their power plants are the same type as used in most of the nation's famous streamlined trains, in transcontinental coaches and in submarines and other naval craft. They are as flexible as gasoline power, notably smoke-free and simple to operate and service.

No Other Diesel Like It—

GMCs are the only 2-Cycle Diesel trucks on the market. They give you much more power per pound of engine weight and almost twice as much pulling power per inch of engine size.

Our own YMAC Time Payment Plan assures you of lowest available rates

GMC

GASOLINE-DIESEL

The Truck of Value

WELDED CONSTRUCTION

Proved AND Improved!

Written into the records on thousands of jobs — under all digging conditions — is the outstanding success of this more modern construction with both upper and lower structures each welded into a rigid unit of rolled alloy steel.

There remains no reasonable doubt about the advantages of this design, originated and developed by P&H to a far greater extent than is found in any other excavator.

P&H

S-M-O-O-T-H-E-R than any excavator you ever ran. Try P&H's Hydraulic control.



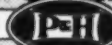
**2000
1930**

OF THE TOUGHEST
EXCAVATORS EVER
BUILT — THAT'S P&H
ROLLED STEEL DESIGN

General Offices: 4494 West National Avenue, Milwaukee, Wisconsin

**HARNISCHFEGER
CORPORATION**

EXCAVATORS • ELECTRIC CRANES • ARC WELDERS



HOISTS • WELDING ELECTRODES • MOTORS

**More
Service
from
Your
Wire
Rope
Dollar**

Protection Against Wear and Weather

THIS is no time to have to replace wire rope because of undue wear, rust or corrosion. Today, with the scarcity of materials every productive hour counts double.

You can get longer service from your wire rope by protecting it with *Texaco Crater*.

Texaco Crater penetrates to the core, coating each individual wire of each strand with a highly viscous film that protects against wear, rust and corrosion.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred on prominent construction jobs throughout the country.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

FOR YOUR ENJOYMENT • TWO GREAT RADIO PROGRAMS



FRED ALLEN every Wednesday night. See your local newspaper for time and station.

METROPOLITAN OPERA. Complete broadcasts of great operas every Saturday. See your local newspaper for time and station.



TEXACO Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

RETURN METAL DRUMS PROMPTLY . . . thus helping to make present supply meet industry's needs and releasing metal for National Defense.



MAKES GEARS LAST LONGER, TOO

Texaco Crater clings to gear teeth, cushioning load shocks, preventing metal-to-metal contact, deadening the noise. Doesn't channel, ball up, or throw off.

THEY PREFER TEXACO

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

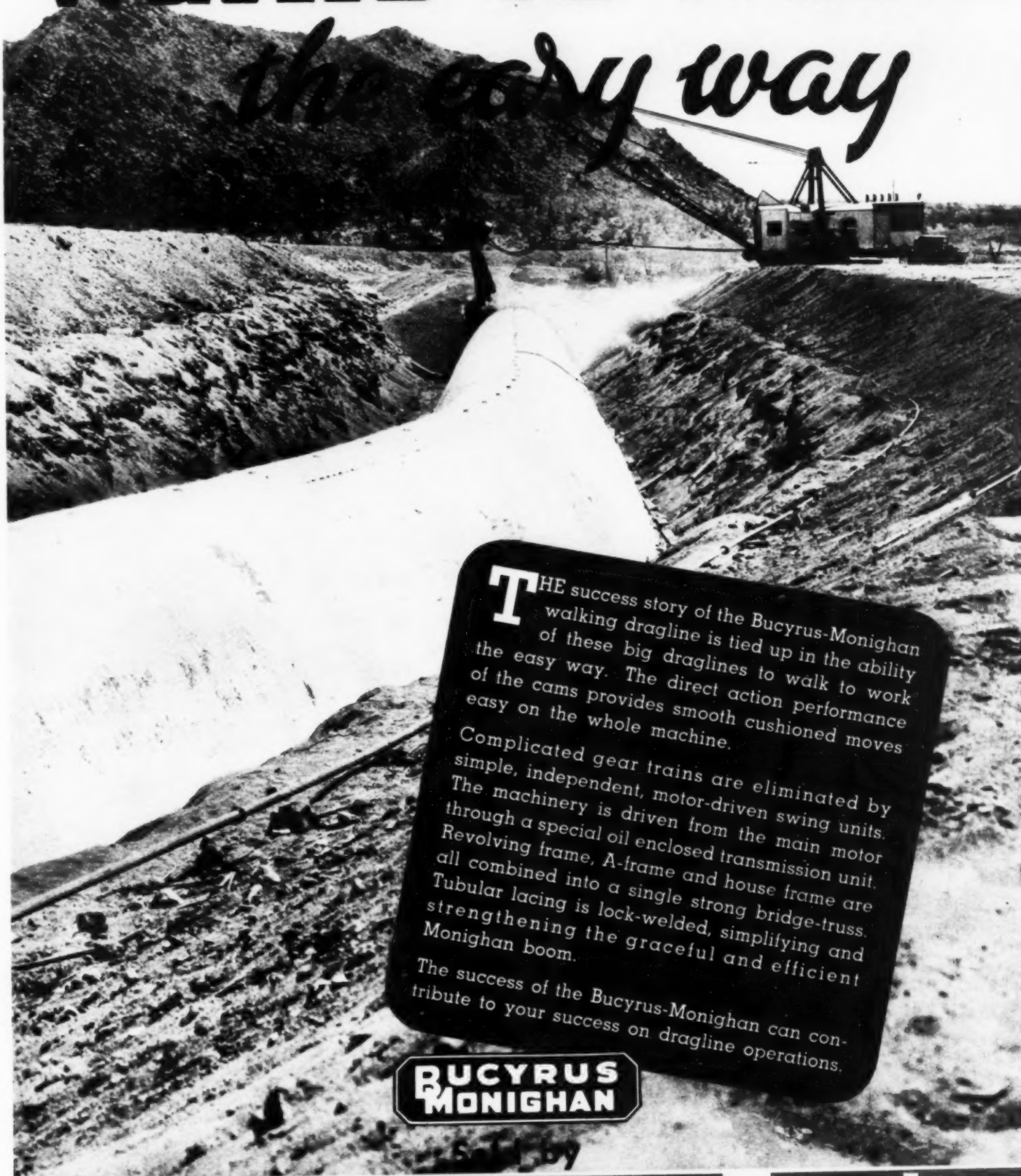
★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

Walks to Work

the easy way



THE success story of the Bucyrus-Monighan walking dragline is tied up in the ability of these big draglines to walk to work the easy way. The direct action performance of the cams provides smooth cushioned moves easy on the whole machine.

Complicated gear trains are eliminated by simple, independent, motor-driven swing units. The machinery is driven from the main motor through a special oil enclosed transmission unit. Revolving frame, A-frame and house frame are all combined into a single strong bridge-truss. Tubular lacing is lock-welded, simplifying and strengthening the graceful and efficient Monighan boom.

The success of the Bucyrus-Monighan can contribute to your success on dragline operations.

**BUCYRUS
MONIGHAN**

Bucyrus-Erie

S O U T H M I L W A U K E E , W I S C O N S I N



They're
"Working in the Dry"
on the
**WILLOW RUN
BOMBER PLANT**

Ypsilanti, Mich.

*Foundation for Administration Building—
approximately 16' deep.*



High speed progress
made possible by
**MORETRENCH
WELLPOINT
SYSTEM**

*Unsheeted drainage structure quickly ex-
cavated by dragline.*

Speed Production

EVERY JOB A DRY JOB

Creation of a vast industrial plant at top speed on a 439 acre plot for the production of giant bomber planes was the problem confronting the contractors on the \$58,500,000 Willow Run Project for the Defense Plant Corporation. Rapid predraining of the site was imperative. Normal ground water level was within 3 or 4 feet of the surface; soil, a mixture of fine and coarse sand, blue gumbo and clay. Installation of approximately 45 Moretrench Wellpoint Systems by the various contractors enabled them to lower the ground water level below

subgrade which permitted excavation and construction of deep foundations, tunnels, and sewers in the dry. Since June, Moretrench demonstrators skilled in the installation and operation of the equipment have been on the job getting bone-dry results in the shortest possible time. **SPEED TODAY IS VITAL.** Moretrench has the material, the experience, and the personnel to handle your wet work **FAST.** Get going with a **MORE-TRENCH WELLPOINT SYSTEM** on the job!

MORETRENCH CORPORATION

ROCKAWAY, NEW JERSEY

90 WEST STREET, NEW YORK
JOLIET, ILLINOIS

NEW ORLEANS, LOUISIANA

Our Mutual Task

THERE can be no better time than this beginning of 1942 to thank our customers for their unfailing patience and the consideration they have shown in the past twelve months toward our efforts to supply the myriad emergency demands for steel.

Today you as consumers and we as producers of steel have a mutual task of achieving the maximum output of materials for war. We must also produce materials for the indispensable minimum of goods for our domestic economy.

The coming of active warfare has made our mutual task as the year opens increasingly arduous. Bethlehem is exerting the utmost effort to meet unprecedented demands. It is our purpose to serve our Government to the utmost of our ability in this emergency. More than 800,000 tons of steel capacity has already been added, together with accompanying increase in coke

ovens and blast furnaces, and expansion of finishing facilities. Further expansions in ingot capacity, and in rolling mills, forges and shops, are anticipated. We are purchasing a wide variety of materials from more than 10,000 suppliers. Our employment rolls have been stepped up to more than 180,000.

With all of this, the demand for our products continues unabated, and 1942 will continue to require the full cooperation and understanding between steel maker and steel user.

It is a gratifying and typical characteristic of American industry that all the needs of our Government and of our national purpose have been met on all sides during the past year with vigor and cheerfulness.

Now is added a still greater and unremitting determination. We know that there will be the whole-hearted cooperation of all, so that what needs be done, shall be done.

*"Enough, if something from our hands have power,
To live, and act, and serve the future hour."*

BETHLEHEM STEEL COMPANY



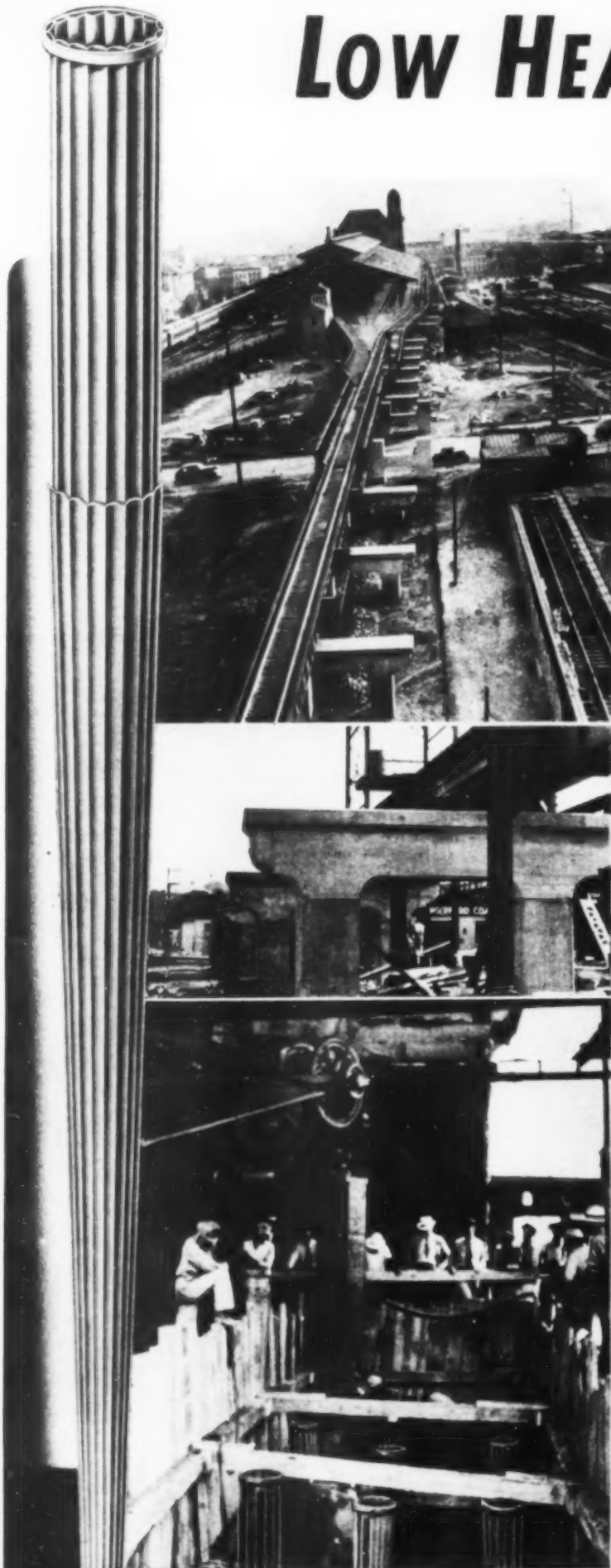
LOW HEADROOM Caused No Headaches On This Piling Job!

Extendable Monotubes Permit Installation of Elevated Track "Under Traffic" With Big Time and Money Savings

CONSTRUCTION of this 4000-ft. elevated track and viaduct in Richmond, Va., by the Seaboard Airline Railway presented a major piling problem. Plans called for building the structure under the present tracks, which meant driving many of the piles for the 59 piers in locations offering only about 20 ft. of headroom. Only a sectional pile could be used if traffic was to be maintained. Otherwise, traffic would have to be rerouted and portions of the old structure removed at a tremendous cost in both time and money.

Use of Union Metal Extendable Monotubes proved to be the practical solution. 800 of these tapered steel casings, averaging 20 ft. in length, were driven in 10-ft. sections. Despite difficult working conditions, installation of the finished cast-in-place piles was completed in about 50 working days.

The principle of Extendable Monotubes is just this—you drive the main lower tapered section, then add constant taper sections to obtain the desired total length. Any number of extensions, which are available in 12", 14", 16" and 18" diameters, can be added to produce a cast-in-place concrete pile of the exact length required—thus eliminating unnecessary waste and permitting installation in low headroom areas. Write today for catalog describing Extendable Monotubes—they can speed your job and save you money.



Engineers
SEABOARD AIRLINE R. R.
W. D. FAUCETT, *Ch. Engr.*; L. H. HORNSBY,
Bridge Engr.; T. BRADY, *Resident Engr*
Contractor
HALEY, CHISHOLM & MORRIS
Charlottesville, Va.

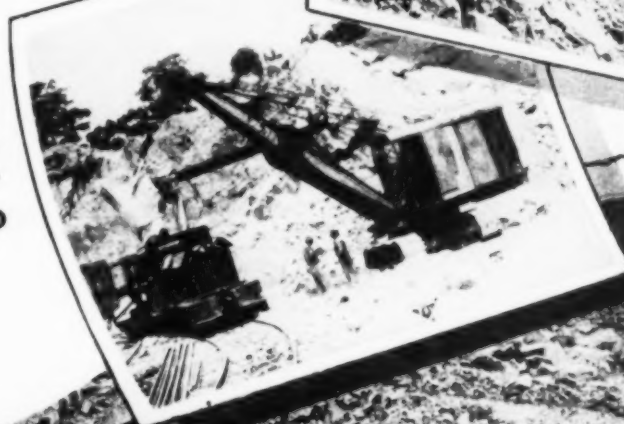
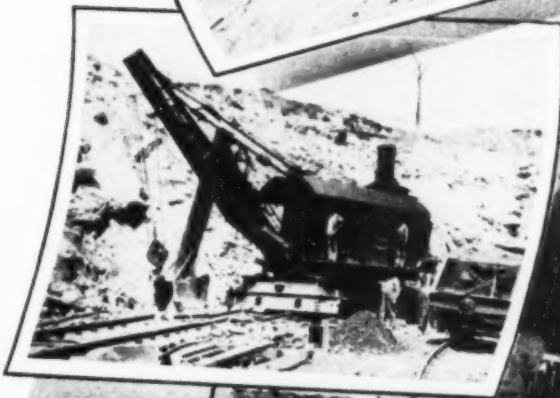
**THE
UNION METAL
MANUFACTURING CO.**
CANTON, OHIO

ROCK is no TOUGHER today than in 1895

• You can't do the same thing for 47 years and not learn a lot about it—and Thew started to learn about rock shovels in 1895, when the first Thew was produced.

Though rock is no tougher today than in 1895, Thew's Lorain rock shovels are! The new, modern 2-yd. Lorain-82 pictured below typifies the latest in Thew's long line of rock shovels. It's a vast improvement over the "old timers," shown above, in power, strength, speed and output. It's but one of the many current Lorains that reflect the value of this 47 years' experience . . . a value which they demonstrate in today's terms by digging more rock, faster, at lower cost.

THE THEW SHOVEL COMPANY, LORAIN, OHIO



LORAIN
Rock Shovels
Since 1895



Next Month...

ANNUAL ROAD BUILDERS' NUMBER FEBRUARY ISSUE, CONSTRUCTION METHODS TIMELY... IMPORTANT... AUTHORITATIVE

★ ★ ★ ★

U. S. roads will play a vital part in our war effort. Not only *strategic* highways for actual military operations. But also access roads to war production and training areas. Thus this issue will be particularly timely and important. Here's the editorial lineup, which is subject to additions or changes:

Roads in Army Maneuvers

The leading article will be an authoritative discussion — profusely illustrated with action pictures — of the part played by highways in the recent Army maneuvers in the Carolinas and Louisiana. It will describe the functions of road building, maintenance and bridge construction under simulated conditions of actual warfare, covering also the organization and mechanical equipment used by troops in the field for road-building and maintenance purposes. The author is Lieut.-Col. A. Robert Ginsburgh of the General Staff Corps, Office of the Under Secretary of War.

Access Roads

Number One highway problem today is provision of access roads to military and production centers. This problem will be fully discussed in the February issue.

From Nebraska comes the story of a 5-mile link between Omaha and Fort Crook. Valued at \$575,000, the project involves 535,000 cu.yd. of grading, 153,000 sq.yd. of reinforced concrete pavement and 52,500 lin. ft. of bituminous-processed stabilized soil-cement-gravel shoulders.

From Ohio—a 12-mile job of reconstruction, widening and paving with a brick surface, on Route 18, serving important industrial areas, including Youngstown and Akron. A feature of this construction is the installation of median traffic-separation strips of white cement with light-reflecting surfaces.

Army Camp Roads

What it means to provide the area within a large Army camp with adequate traffic facilities is told in a story of bituminous paving at Fort Leonard Wood, Missouri. The job required the construction of 53 miles of streets and roads, in addition to more than 200,000 sq. yd. of motor vehicle parking areas. Total cost about \$700,000.

Bypass Construction

Modern highway design and location avoids the practice of routing traffic through large cities. Particularly significant, therefore, will be the article describing the concrete paving of a bypass road, known as the East Belt, around Grand Rapids, Mich. Features of the project are the use of a special sand subgrade under the slab, minimum water-

cement ratio for the concrete, screw-spreader for distributing concrete, vibratory finishing machine, and an admixture (Orvus) to produce scale-resistance and improve durability. Also joint seal of rubber compound.

Tar Concrete

Another article will deal with tar-concrete paving in Wisconsin. This job involved hot-mix, hot-laid surfacing 2 in. thick in two 11-ft. lanes, using a combination spreader-finisher. A feature of the contractor's setup is a central bituminous mixing plant.

Airport Paving

While war conditions are certain to reduce the annual volume of general road-building work, except for military and access road purposes, this reduction will be substantially offset by a large-scale program of paving of airport runways and aprons. For the February issue a couple of airport stories are scheduled.

Earth-Moving and Grading

An important analytical article, replete with photographs and charts of time studies and production rates, will tell "How to Get More Work from Tractor Power." Today one of the most widely used methods of earth-moving is by tractor-scraper equipment. Kenneth F. Parks, Chief Field Engineer for R. G. LeTourneau, Inc., explains in a thoroughly practical way how to move more earth at lower cost.

Another decidedly out-of-the-ordinary story will tell how concrete highways in California, damaged by severe floods, were repaired and put back into service.

Industrial Flooring

While not nominally classified as "road-building," the concrete paving of the immense floor areas required by many of our industrial plants engaged in producing equipment for war, notably airplanes, is essentially a large-scale paving operation. At a big bomber assembly plant in Texas a huge concrete floor area was surfaced with *white cement* in order to produce better light-reflecting conditions for mechanical operations. Pictures and descriptive text will tell how this job was handled.

Don't miss this important and timely issue. You'll find in it much helpful and practical information, illustrated with scores of on-the-job action pictures.

So, if you plan to change your address, inform us immediately to insure that your copy reaches you promptly. Write to:

CONSTRUCTION METHODS

330 West 42nd Street, New York, N.Y.

★ A MCGRAW-HILL PUBLICATION ★

WHY RISK AN OIL THAT MAY **CRACK UP?**



Lubricate your hard-
working Diesels with

**SHELL
RUDIS OIL
FOR HEAVY DUTY**

(Sold West of the Rockies as Shell E-980)



SHELL RUDIS OIL . . .

- 1 Has high oxidation stability.
- 2 Keeps rings and pistons free.
- 3 Is non-corrosive to bearing metals.
- 4 Reduces lacquer, varnish and sludge formation.
- 5 Cuts down engine wear.

Proved in toughest service, Shell Rudis Oil has shown it stands up under the most severe operating and temperature conditions. Get the unglossed facts from the Shell man now. Let him help you to speedier production, lower maintenance costs.

Now It's # **3 $\frac{1}{2}$** **SMITH-MOBILE**



BIG CAPACITY
Larger 165 cu. ft. drum
volume—permits a much
bigger payload.

Forging Ahead in Truck Mixer Design

Five years ago Smith-Mobile made its appearance with the industry's first really important changes in truck mixer design. It is the 1st machine that provided for HIGH DISCHARGE without a hoist... 1st with a CONTROLLED DISCHARGE without segregation... 1st with VISIBLE MIXING... 1st with FEED CHUTE charging... 1st to introduce water through the feed opening.

Today, Smith-Mobile is the acknowledged leader in the industry with an enviable record of achievement. Its many distinctive features have been thoroughly field-tested. More than 700 machines are now in active service.

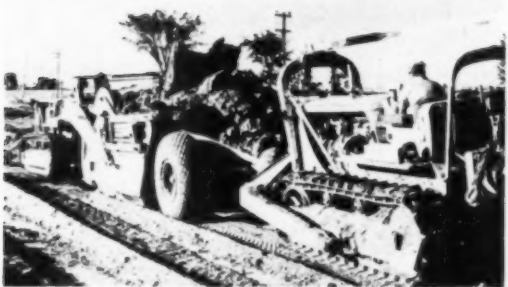
Backed by this broad, successful experience, Smith Engineers have developed a new, compact, streamlined truck-mixer — the No. 3 $\frac{1}{2}$ Smith-Mobile. With its larger 165 cu. ft. drum volume, this new machine permits bigger payloads, yet it actually weighs less than competitive 3-yard truck mixers. It's faster all the way... in charging, mixing, discharging... especially for the drier and stiffer mixes. Write for complete Smith-Mobile Catalog No. 198-B — it's just off the press.

The T. L. SMITH CO., 2851 N. 32nd St., Milwaukee, Wis.

Ratings
3 $\frac{1}{2}$ cu. yds. for
truck mixing...
4 $\frac{1}{2}$ cu. yds. for
agitating.

LIGHTWEIGHT
New, compact design ef-
fects weight economy —
increases efficiency.

CONCRETE MIXER MANUFACTURERS SINCE 1900



NO. 586-C

In these and other industries MACWHYTE Wire Rope, Slings, and Aircraft Cables are speeding progress, saving money:

Wire Rope for MINING
Crane Slings for STEEL MILLS
Slings for ARSENALS
Wire Lines for OIL FIELDS
Cable Controls for AIRPLANES
Wire Rope for INDUSTRIAL CRANES
Rope and Slings for SHIP RIGGING
Wire Rope for LOGGING

2 KINDS OF WIRE

in Monarch PREformed



.. help conserve man hours .. save steel

Fewer shutdowns for rope replacement ... lower actual rope costs ... better all 'round service ... Monarch Whyte Strand PREformed has always meant these.

But using PREformed today means much more. Because it lasts much longer than non-preformed, PREformed pro-

vides great savings in steel tonnage with the result that more men and more steel are available for vital defense needs. Help yourself to lower cost service; help defense, too, by buying PREformed. Make sure you get the CORRECT rope for your equipment: get Monarch Whyte Strand PREformed.

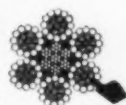
1 .. outer wires

in each strand are Monarch PREformed's first line of defense. They have maximum tensile strength and great abrasive resistance.



2 .. inner wires

in each strand are the reserve strength of the rope. They are specially drawn with maximum flexibility and toughness for inside service.



3 .. all wires

in Monarch Whyte Strand PREformed are improved plow steel. Each wire is covered with heavy, tenacious, lasting protection: Macwhyte Internal Lubrication.

Please feel free to call on Macwhyte any time you would like us to check over your equipment. We'll do it without obligation and give you recommendations based on our experience on hundreds of cases similar to yours.

MACWHYTE COMPANY, 2941 Fourteenth Avenue, Kenosha, Wisconsin. Manufacturers of wire rope to meet every need—Left & Right Lay Braided Slings—Stainless Steel Wire Rope—Aircraft Cable, Aircraft Tie Rods, and "Safe-Lock" Swaged Terminals.


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MACWHYTE EXCAVATOR ROPES

The correct ropes for your equipment

PRE-FORMED FOR BEST PERFORMANCE





**The grip
that gets
today's job
done....
TODAY!**

Deep-cut, open center lugs
give you:

66% MORE TRACTION
in hard snow on hard road

36% MORE TRACTION
in soft snow on hard road

33% MORE TRACTION
in shallow mud

12% MORE TRACTION
in six-inch-deep mud and—

**FAR MORE POWERFUL
REVERSE TRACTION**

GOODYEAR SURE-GRIP GRADER TIRE

TO do your part in America's war effort, it's now more important than ever that you have tires designed to march through any kind of going — soft ground, snow, mud.

Actual tests have demonstrated that the new Goodyear Sure-Grip Grader tire provides more traction than ever before — under some conditions as much as 66% more!

But in addition to extra pull, this tire gives you something equally important — operating economy. That open center tread is self-cleaning—earth won't pack it and slow you down. Special construction of sidewalls and tread insures better, longer wear.

Sturdier non-rocking beads, a wider breaker unit,

a stronger high-tensile cord carcass—all these improvements make the Sure-Grip the lowest-cost-per-mile tire for its purpose that you can buy.

The Goodyear Sure-Grip Grader is available in popular sizes for graders and maintainers. Order from Goodyear dealers for present equipment — specify on new equipment.



Off-the-road equipment is doing yeoman service in America

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Construction Methods

ROBERT K. TOMLIN, Editor

Volume 24

JANUARY, 1942

Number 1

Improvised Swing Pontoon **SERVES PEDESTRIAN TRAFFIC**

TO SAVE STEPS for pedestrians and to accommodate transfer of street car passengers from one side of the Chicago River to the other while the Cermak Road bascule bridge was being put into condition to carry all detoured traffic during the two years required for removal and replacement of the existing Canal St. bridge, the Chicago Department of Public Works installed a swinging pontoon bridge consisting of a 120-ft. scow moored at one end by a swivel collar to a pile clump. The swing pontoon, which revolved through a 90-deg. arc to permit passage of river traffic, was self-propelled in both directions by a paddle wheel driven by a small engine on board. Opening the bridge required about 1¼ min. Moored scows at the west end and stairways to the present bridge level completed the temporary pedestrian crossing, as indicated by the photographs.

Oscar E. Hewitt is commissioner of the Department of Public Works, City of Chicago. The photographs were supplied through the courtesy of W. W. DeBerard, city engineer.



TEMPORARY SWING BRIDGE utilizing 120-ft. barge propelled by paddle wheel and small power plant on board provides pedestrian detour across Chicago River while bascule rockers of Cermak Road bridge, in background, are being repaired with bascule bridge in raised position.



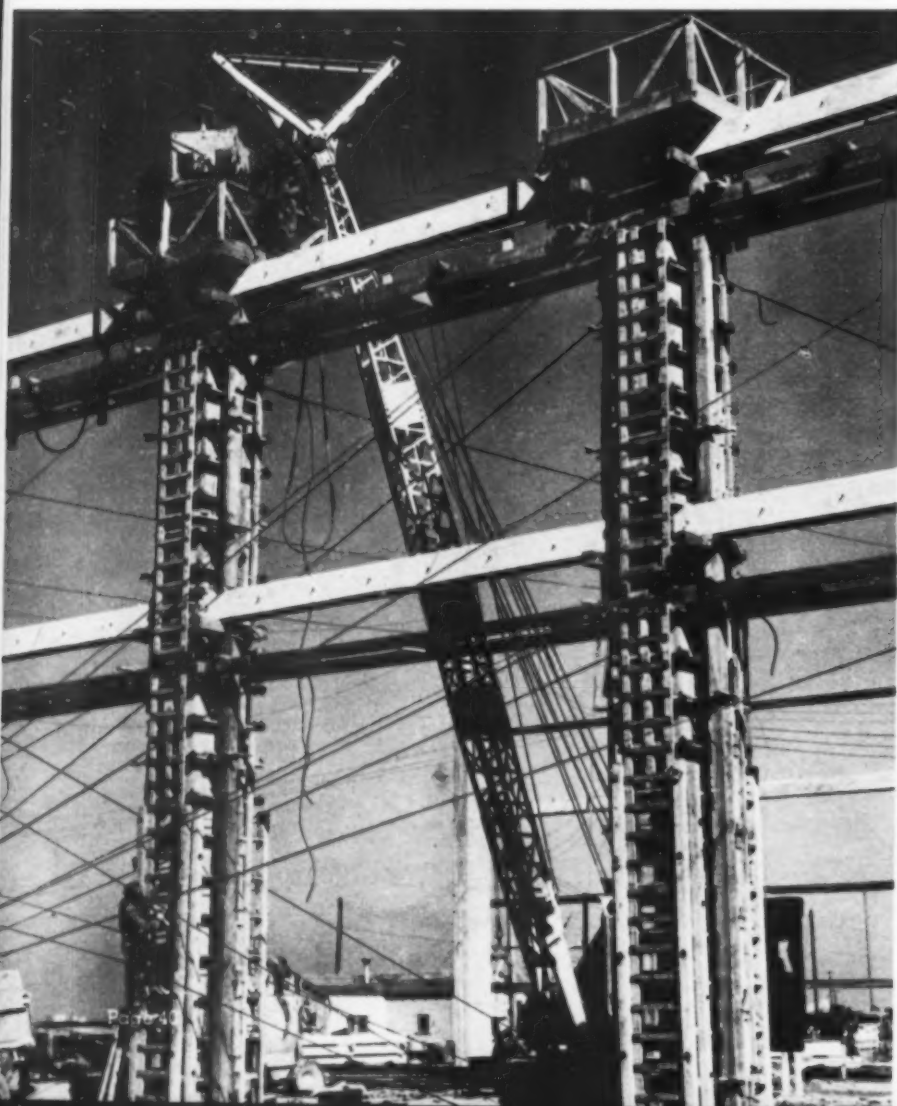
SWIVEL COLLAR around pile clump in foreground permits pontoon barge to swing through 90-deg. arc when propelled by paddle wheel at far end.

ARMED GUARDS PATROL Golden Gate Bridge in San Francisco as measure of protection against sabotage since declaration of war between United States and Japan. In background is one of tall steel towers supporting world's longest cable suspension span of 4,200 ft.



Wide World Photo

SOUTH'S NEWEST STEEL MILL (below) at Port Arthur, Texas, is being rushed by Spence-Howe Construction Co., of Port Arthur, to meet schedule calling for operation by Texasteel Manufacturing Co. in spring of 1942. Plant will manufacture shells for army and navy. Photo shows pouring of 40-ft.-high concrete columns for main building, 450x85 ft. in plan.



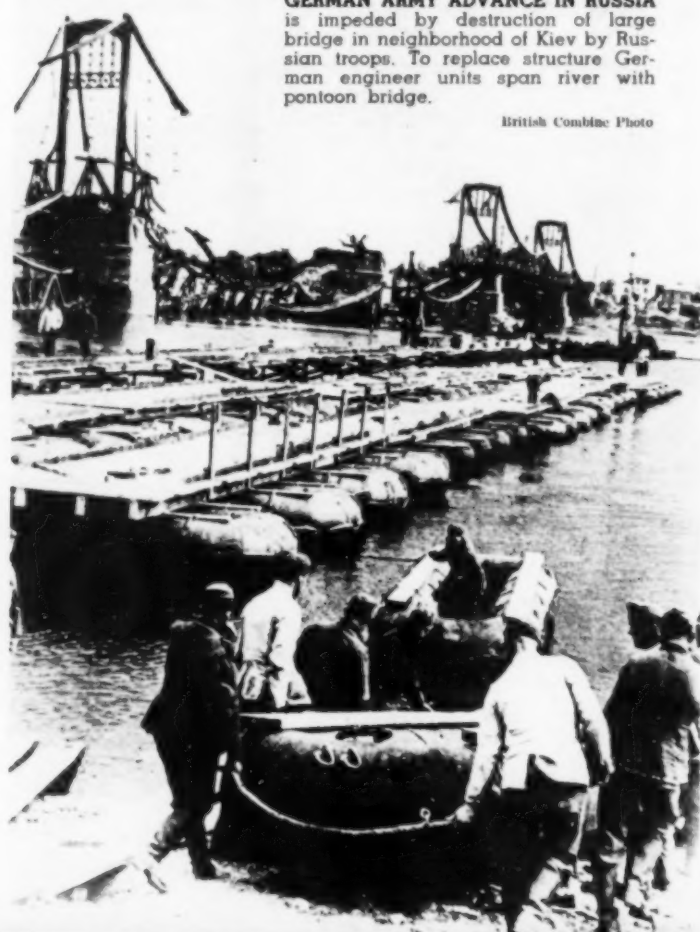
THIS MONTH'S NEWS REEL



NEW WAR DEPARTMENT OFFICE BUILDING at Arlington, Va., on Potomac River opposite Washington, D. C., is scene of construction activity as group of contractors comprising John McShain, Inc., of Philadelphia, Doyle & Russell and Wise Contracting Co., both of Richmond, Va., pour concrete for second-floor beams and decking of \$31,000,000 structure. Three-story structure will be in form of huge pentagon, consisting of two concentric rings of building around 6-acre inner court.

GERMAN ARMY ADVANCE IN RUSSIA is impeded by destruction of large bridge in neighborhood of Kiev by Russian troops. To replace structure German engineer units span river with pontoon bridge.

British Combine Photo





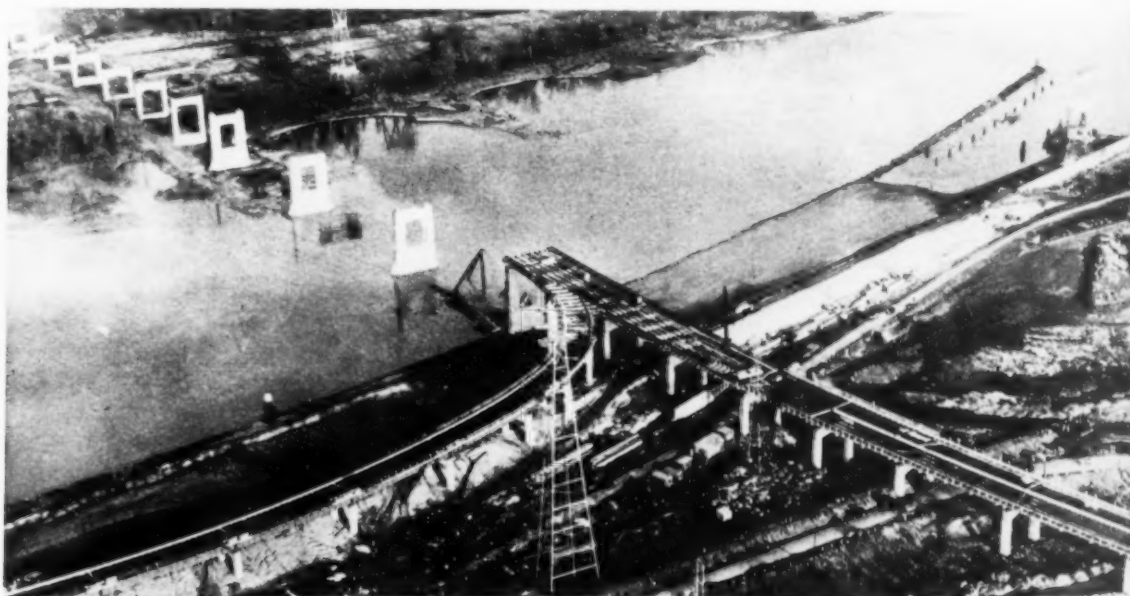
BRITAIN'S ALL-OUT DEFENSE PROGRAM, in order to conserve man power for military service, enlists aid of English girls to operate American-made Rex concrete mixer on construction of airport.



THREE-UNIT AIRCRAFT PLANT of Goodyear Aircraft Corp. nears completion at Akron (Ohio) municipal airport. In foreground is Defense Plant Corporation's 400x1,000-ft. building leased by Goodyear for manufacture of airplane sub-assemblies. In rear, at right, is new airplane parts structure. Airship hangar or dock, in background, world's largest building without interior supports, is now equipped for producing aircraft parts.



CLOSURE OF CANTILEVER SECTIONS (below) is accomplished on lofty, double-deck Pit River Bridge, with overall length of 3,588 ft., built by American Bridge Co. to carry both railway and highway traffic around reservoir area of U. S. Bureau of Reclamation's Shasta Dam in California. Stiff-leg derrick lowers girder into place to close gap in upper chord of structure supported by concrete piers 360 ft. high.



STEELWORK COLLAPSES Dec. 4 as 270-ft continuous steel girder section is being erected with aid of falsework for new bridge across Connecticut River at Hartford, Conn. Structure with overall length of 3,950 ft. has main spans of 270-300-270 ft. Failure of falsework bent on timber piles supporting steel girder in first 270-ft. span has been suggested as possible cause of accident. Failure caused death of W. J. Ward, erection superintendent for American Bridge Co., and other construction workers.



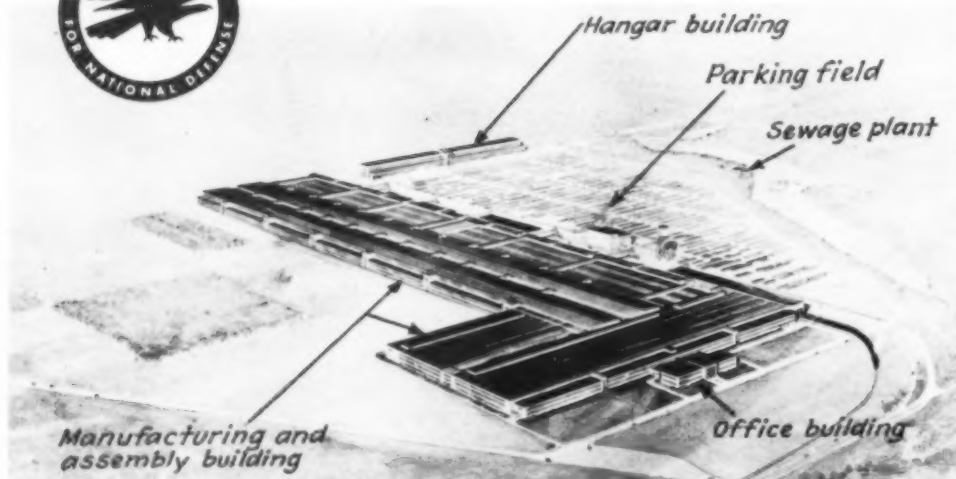
AT FRANKLIN FALLS DAM (below), flood control structure for U. S. Engineer Department in New Hampshire, Coleman Bros., contractors, of Boston, Mass., are sprinkling and compacting with sheepfoot rollers impervious core and pervious downstream and upstream sections of \$4,265,853 earth fill. Project is being built under direction of Lieut. Col. L. B. Gallagher, district engineer of U. S. Engineer Office at Boston, Mass.



Seven Month Schedule

COMPLETES 62-ACRE BUILDING FOR Ford Bomber Plant

By VINCENT B. SMITH
Associate Editor
Construction Methods



COVERING 1,500 ACRES of land, huge bomber manufacturing plant and auxiliary airport more than 1 mi. square spring into being in seven months near Ypsilanti, Mich., about 25 mi. west of Detroit.

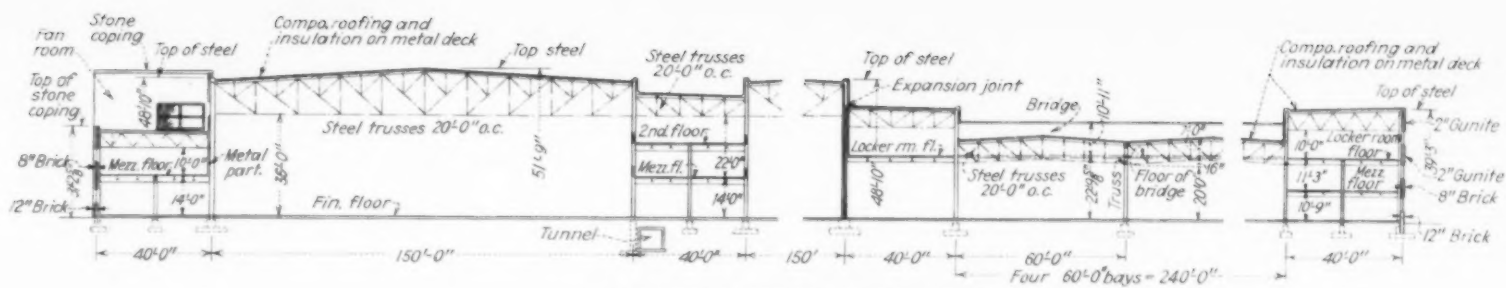
HOUSING A 62-ACRE AREA for production of giant bomber air frames under a single roof was the nub of the problem that confronted the Ford Motor Co. and Albert Kahn Associated Architects & Engineers, Inc., in planning the Willow Run bomber plant at Ypsilanti, Mich., now nearing completion under a federal financing arrangement which provides funds and top policy supervision through the agency of the Defense Plant Corp. Following the drafting of general plans by the Albert Kahn engineer-architects in cooperation with the Ford Motor Co., which will operate the plant, a group made up of both competitive-bid and fixed-fee contractors took over the task of matching strides in the field against the exacting progress schedule drawn up by Kahn executives at the instance of an important War Department. The Bryant & Detwiler Co., Detroit, heads the list of plant contractors, not because the firm obtained the first or the largest contract, but because its agreement with

Breakdown of Estimated Costs for Willow Run Bomber Plant

Land and land improvements	\$4,703,674
Buildings and building installations	37,021,402
Machinery and equipment	14,102,805
TOTAL	\$55,827,881
Grand total estimated cost	\$58,500,000

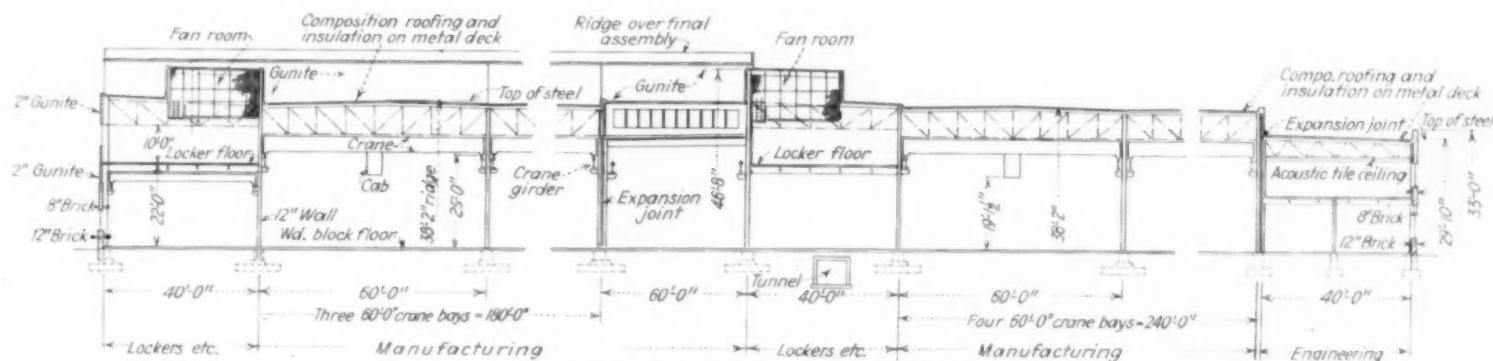


VAST PLANT BUILDING requiring 27,000 tons of structural steel and 26,000 squares of roofing advances rapidly toward completion under drive by mechanized army of workmen aided by ample equipment.



TYPICAL SECTION THROUGH ASSEMBLY BUILDING

TWO 150-FT. BAYS for major assembly and final assembly and four 60-ft. bays for sub-assembly make up bulk of 700-ft. width of assembly area 2,800 ft. long. Overhead bridges provide employee access between locker rooms on upper floors and parking fields on south side of building.



SECTION THROUGH MANUFACTURING WING

TEN CRANEWAYS in 60- and 40-ft. bays provide facilities for handling parts between machines in manufacturing area. Along west wall of building 40-ft. bay 1,200 ft. long is reserved for engineering offices, laboratory, hospital, lunch rooms and toilets.

the Ford Motor Co. names it as the coordinator of all inter-related trades on the big building job. This concern is executing a fixed-fee contract with an original estimated overall value of \$5,000,000, including general masonry and architectural work performed by its own forces. Value of the contract later was increased by inclusion of work on the

power house, hangar building and installation of permanent machinery.

Other important contractors working on the bomber manufacturing and assembly plant, here differentiated for reasons of convenience from the plant's huge auxiliary airport, are mentioned in following paragraphs. Construction of the flying field will be described in a

subsequent well-illustrated article.

Imposing though its dimensions may be, the 62-acre manufacturing and assembly building actually is only the hub and production center of a vast industrial establishment being created on a 439-acre plot bordering the airport on the west. Facing this side of the airfield, just south of the east end of the

FORD MOTOR CO. BOMBER MANUFACTURING BUILDING											
KEY PLAN											
TRADE DIVISION											
QUOTATIONS											
SECTION 1											
SECTION 2											
SECTION 3											
SECTION 4											
SECTION 5											
BIDS AWARDED	AWARDED	START	COMPLETE	START	COMPLETE	START	COMPLETE	START	COMPLETE	START	COMPLETE
EXCAVATION	JULY 20	APRIL 18	AUG 8	JULY 21	AUG 10	AUG 3	AUG 20	SEPT 4	OCT 8	SEPT 15	OCT 15
FOOTINGS	- 20	- 25	- 15	- 28	- 24	- 26	- 25	- 12	- 22	- 17	NOV 1
WALLS BELOW GRADE	- 20	- 25	- 15	- 28	- 24	- 26	- 25	- 12	- 22	- 17	- 1
ELECTRICAL TEMP. CONST.	AUG 5	AUG 5	- 15	- 28	- 24	- 26	- 25	- 12	- 22	- 17	- 1
STRUCTURAL STEEL	- 20	- 25	- 15	- 28	- 24	- 26	- 25	- 12	- 22	- 17	- 1
ROOF DECK	AUG 5	SEPT 1	- 8	SEPT 1	SEPT 21	SEPT 18	OCT 10	OCT 1	NOV 1	NOV 3	DEC 15
ROOFING - SHEET METAL	JULY 30	- 25	- 15	- 28	- 24	- 26	- 25	- 12	- 22	- 17	- 29
STEEL SASH	AUG 5	SEPT 8	- 22	- 28	- 24	- 26	- 25	- 12	- 22	- 17	- 29
GLASS & GLAZING	- 8	- 25	- 15	- 28	- 24	- 26	- 25	- 12	- 22	- 17	- 29
EXTERIOR BRICK WORK	JULY 20	AUG 5	- 22	- 28	- 24	- 26	- 25	- 12	- 22	- 17	- 29
GUNITE	AUG 5	- 8	- 22	- 28	- 24	- 26	- 25	- 12	- 22	- 17	- 29
FLOOR ON GROUND	JULY 20	SEPT 25	OCT 1	SEPT 21	- 26	OCT 6	NOV 14	- 21	DEC 6	DEC 5	- 19
CREOSOTED WOOD BLOCK FLOOR	AUG 8	SEPT 1	- 8	- 28	NOV 3	- 3	- 21	- 28	NOV 15	- 12	- 26
MELTANINE - 2ND FLOOR SLAB	JULY 20	AUG 21	- 1	- 28	OCT 5	SEPT 22	OCT 24	- 7	NOV 21	- 29	- 29
MISCELLANEOUS IRON WORK	AUG 5	- 15	- 28	- 24	- 26	- 25	- 12	- 22	- 17	- 29	- 29
METAL TOILET PARTITIONS	- 8	SEPT 1	- 15	- 28	NOV 6	OCT 6	NOV 25	- 21	DEC 15	DEC 5	FEB 1
METAL OFFICE PARTITIONS	- 8	- 1	- 15	- 28	- 6	- 25	- 21	- 15	- 5	- 5	- 1
PAINTING	- 8	AUG 7	- 15	- 28	- 6	SEPT 20	- 25	- 7	NOV 21	- 1	- 1
ACOUSTICAL WORK	- 15	SEPT 21	- 6	OCT 5	OCT 20	OCT 20	- 18	NOV 5	- 6	DEC 20	JAN 19
MARBLE	- 15	- 31	- 6	OCT 5	- 20	- 20	- 18	- 5	- 6	- 20	- 19
CARPENTER WORK	- 1	AUG 1	- 6	SEPT 7	- 26	SEPT 22	- 18	OCT 7	- 6	NOV 21	- 19
HARDWARE	- 15	- 15	- 6	- 28	- 26	- 22	- 18	- 7	- 6	- 21	- 19
COMPOSITION TILE	- 15	SEPT 21	- 15	- 28	NOV 6	OCT 18	- 25	- 28	- 15	DEC 12	FEB 1
QUARRY TILE	- 15	- 21	- 15	- 28	- 6	- 18	- 25	- 28	- 15	- 12	- 1
HANGAR DOORS	- 15	- 1	SEPT 20	12	OCT 20	SEPT 29	- 7	- 14	NOV 29	NOV 28	JAN 12
FOLDING DOORS	- 15	- 1	- 20	- 18	- 20	- 29	- 9	- 14	- 29	- 28	- 12
HOLLOW METAL WORK	- 15	- 1	- 20	- 28	- 20	OCT 15	- 9	- 28	- 29	DEC 12	- 12
INTERIOR MASONRY	JULY 20	- 15	- 29	- 28	- 20	- 13	- 9	- 28	- 29	- 12	- 12
CLEAN UP	- 20	OCT 6	OCT 15	OCT 19	NOV 6	NOV 3	- 25	NOV 19	DEC 15	JAN 3	FEB 1
UNDERGROUND PLUMBING											
- HEATING	AUG 10	AUG 15	AUG 18	SEPT 22	SEPT 7	OCT 12	SEPT 22	OCT 31	OCT 8	NOV 22	NOV 10
- ELECTRICAL WORK	- 10	- 15	- 18	- 22	- 7	- 12	- 22	- 31	- 8	- 22	- 10
- FIRE PROTECTION	- 10	- 15	- 18	- 22	- 7	- 12	- 22	- 31	- 8	- 22	- 10
ELECTRICAL WORK											
PLUMBING WORK	AUG 21	AUG 15	SEPT 1	OCT 15	SEPT 14	NOV 6	SEPT 29	NOV 25	OCT 14	DEC 15	NOV 28
HEATING & VENTILATING WORK	- 21	- 15	- 1	- 15	- 14	- 6	- 29	- 25	- 14	- 15	- 28

STIFF PROGRESS SCHEDULE drawn up by engineer-architects demands maximum speed in construction operations on big job. Departure from schedule is unavoidable on some items, but completion dates for building determine rates of construction by all contractors.



SHOP-FABRICATED TRUSS for 150-ft. final assembly bay is erected in two parts. Steam locomotive crane of 60-ton capacity, ordinarily used in yard service, swings half of truss into position to be handled by two gasoline-powered crawler-type erection cranes.



SEWAGE PLANT CONSTRUCTION moves smoothly under direction of JOHN C. WESTPHAL (left) superintendent, who pauses to have a word with his office manager.



TRENCH for storm trunk sewer is predrained with Moretrench well points by Gargaro Co.

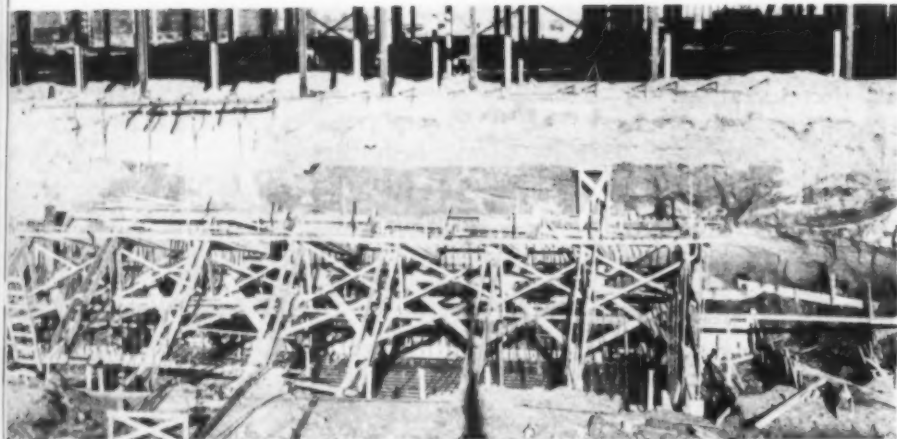
Well points



assembly building, is a 261,400-sq.-ft. hangar structure. More centrally located on the south side of the main building are the plant's power house, oil houses, fuel storage, cooling tower, two water tanks and two substations. On the west side of the main structure are a reinforced-concrete two-story office building and one-story garage with a combined roof area of 26,000 sq. ft. The plant's paint shop has a floor area of 157,000 sq. ft.

At a distance of about 1,500 ft. south of the main building, on the bank above Willow Run, Couse & Sanders, contractors, Detroit, have completed a \$260,000 sewage disposal plant of activated sludge type. This plant and all sewage and water facilities for the entire project were designed by Hubbell, Roth & Clark, Inc., consulting engineers, Detroit.

Steam for heating the entire plant is



DEEP EXCAVATION for transformer room under garage is made by Bryant & Detwiler inside well point system which predrains sand banks above clay layer.

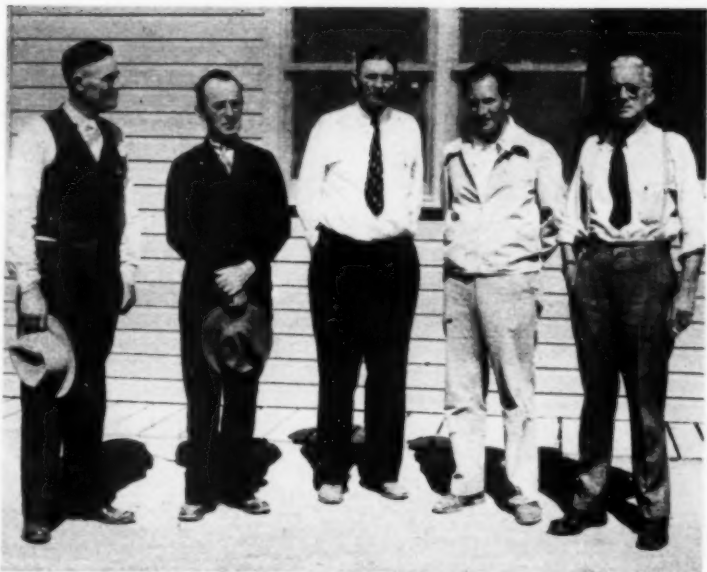
TWO CRAWLER CRANES (below) of Whitehead & Kales erect steel in manufacturing wing.



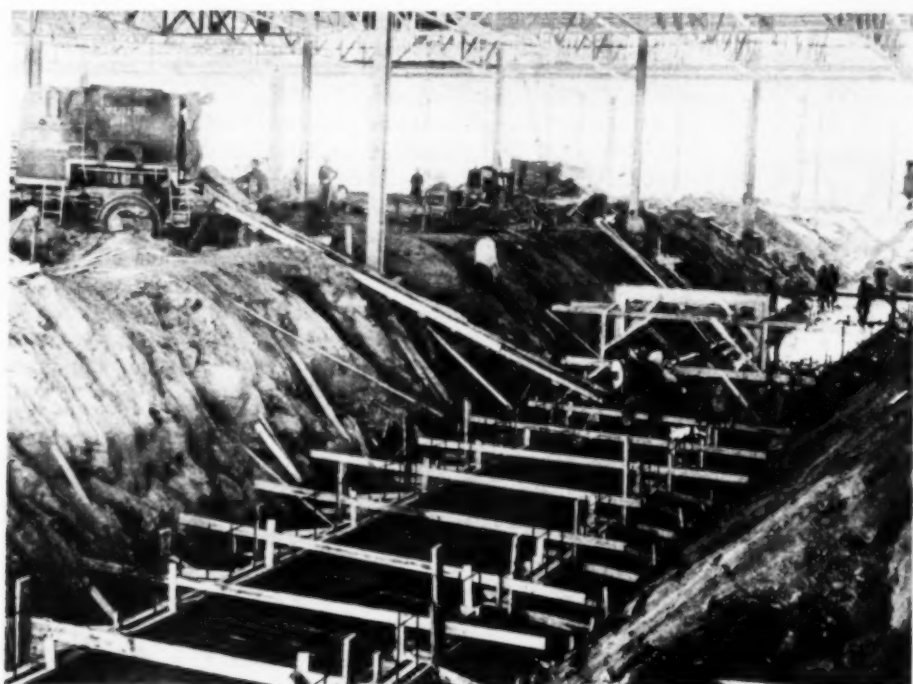
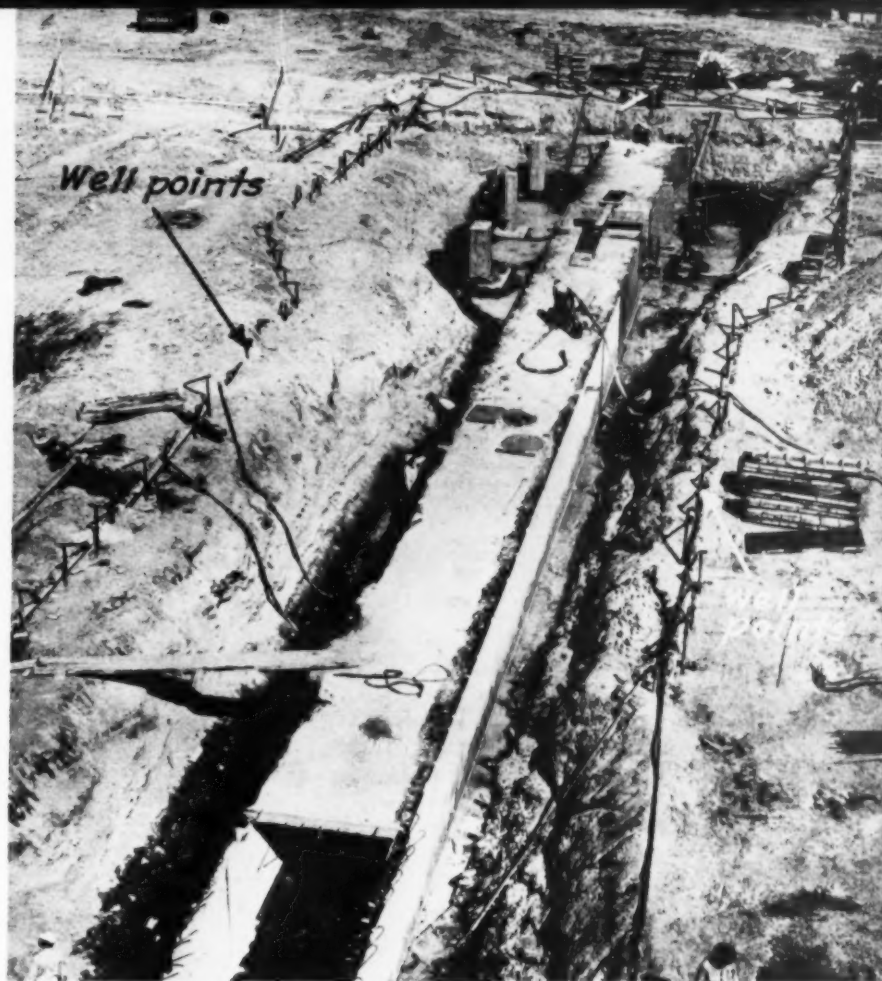
STORM TRUNK SEWERS for bomber plant are put in by Gargaro Co. under supervision of ETOR GARGARO, general superintendent.



INCOMING STEEL is sorted and stocked by Whitehead & Kales with 60-ton locomotive crane in yard. Two crawler cranes in background erect steel in manufacturing wing.



BIG BOMBER PLANT grows apace under unceasing drive by: (left to right) JOHN G. CAMPBELL, general superintendent, Bryant & Detwiler Co. RAYMOND C. BERNARDI, superintendent, Albert Kahn Associated Architects & Engineers, Inc.; EMORY HORST, assistant superintendent, FERDINAND J. OTTO, job engineer, and JACK K. CALDER, superintendent of trades, all three last-named men being with Bryant & Detwiler.



REINFORCED FLOOR SLAB of tunnel is concreted by Ransome truck-mixer in trench predrained with Moretrench well points by J. A. Utley Co.

GUNITE CURTAINS (below) for two upper courses and brick spandrel for lower course make up exterior wall of receiving area. In distance may be seen steel frame for shipping area extending out from main frame of assembly building.

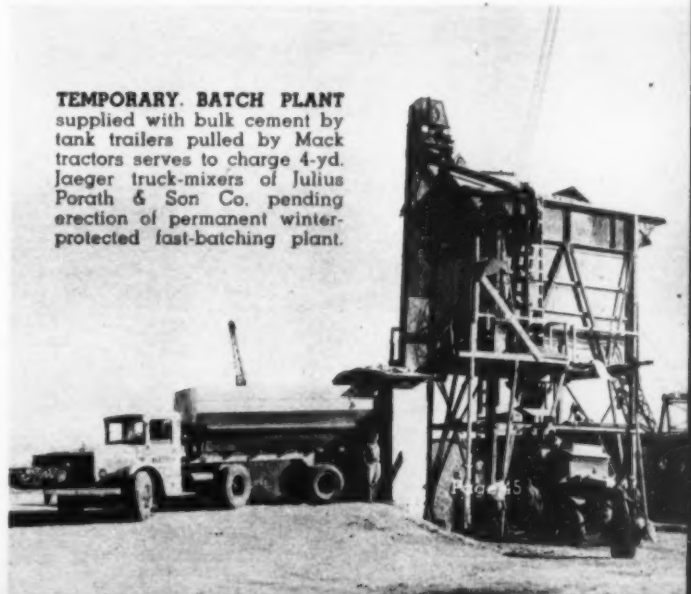


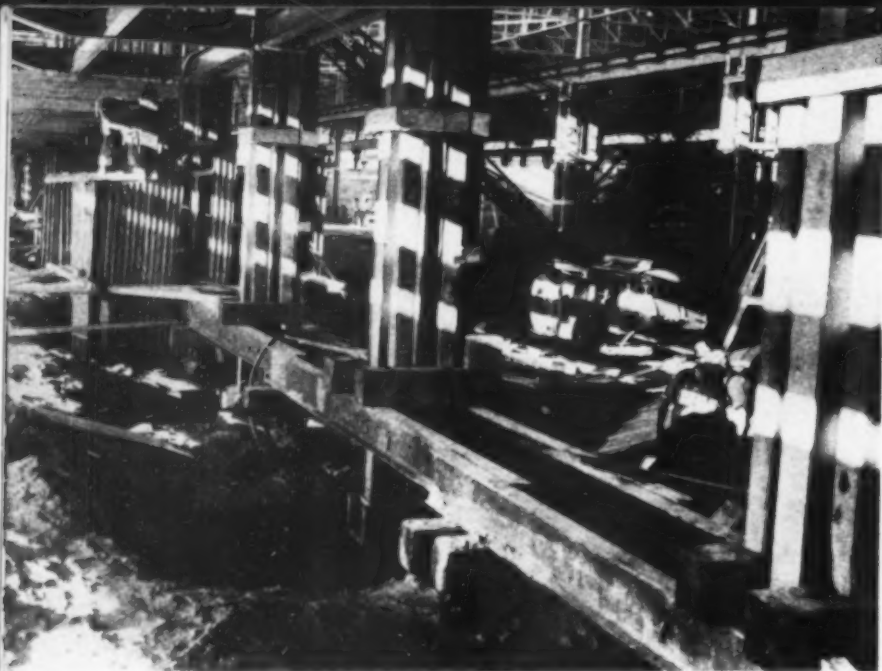
TO LOWER GROUNDWATER LEVEL for tunnel construction, J. A. Utley Co. installs Moretrench well-point system along both banks.



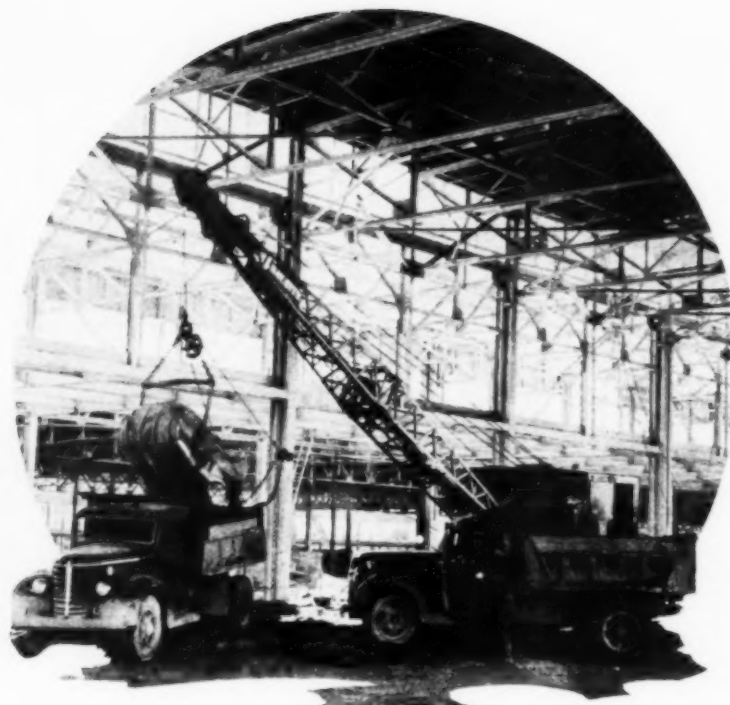
SAND-LIME BACKUP BRICK are tied with headers in every fourth course. Stone sill is laid on top of 8-in. brick spandrel under windows for mezzanine floor of assembly building.

TEMPORARY. BATCH PLANT supplied with bulk cement by tank trailers pulled by Mack tractors serves to charge 4-yd. Jaeger truck-mixers of Julius Porath & Son Co. pending erection of permanent winter-protected fast-batching plant.





PICKED UP on needle beams, fifteen columns in manufacturing area are underpinned to depth below bottom of press pits located later in this portion of building. Browning crane handles air-powered hammer driving corrugated steel sheeting.

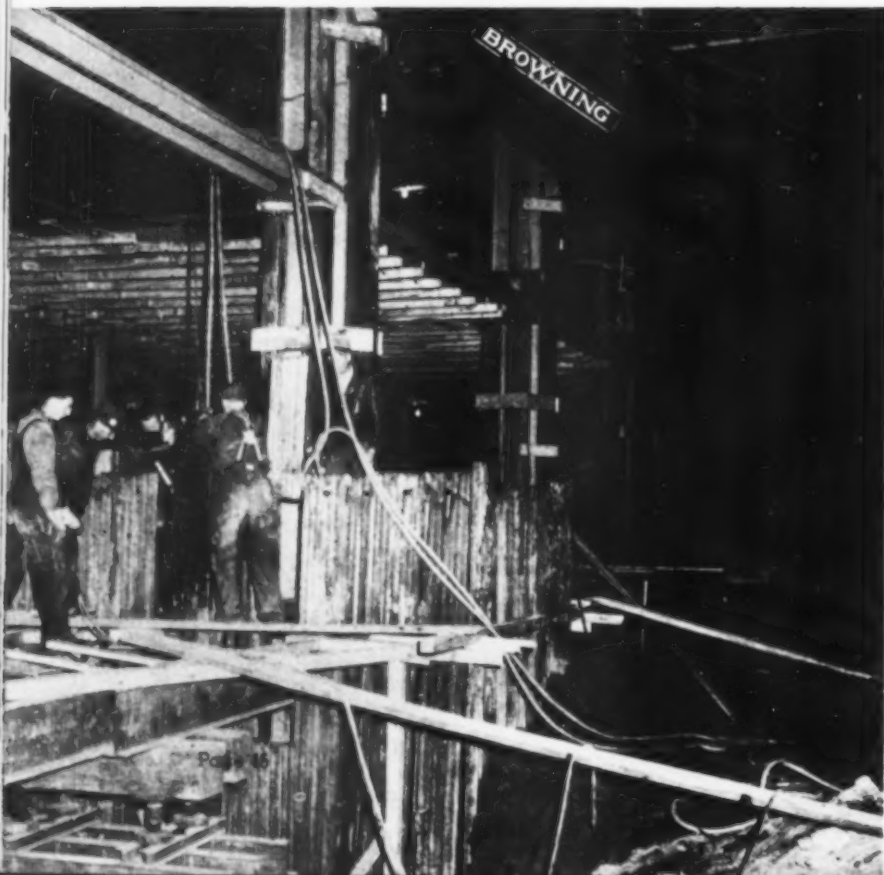


TUNNEL TRENCH inside building is excavated for J. A. Utley Co. by Bay City dragline.

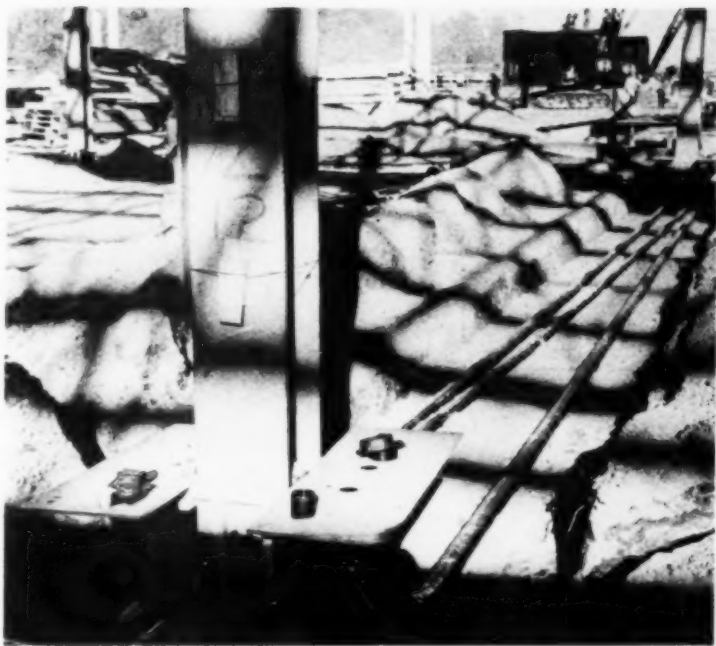


BRICK SPANDRELS and steel sash for continuous windows close exterior wall of engineering building.

NIGHT SHIFT (below) drives corrugated sheets with air-powered McKiernan-Terry hammer for column underpinning.



ELECTRICAL UNDERFLOOR CONDUITS are laid by John Miller Electric Co. in concrete incasement forms approaching manhole in foreground.



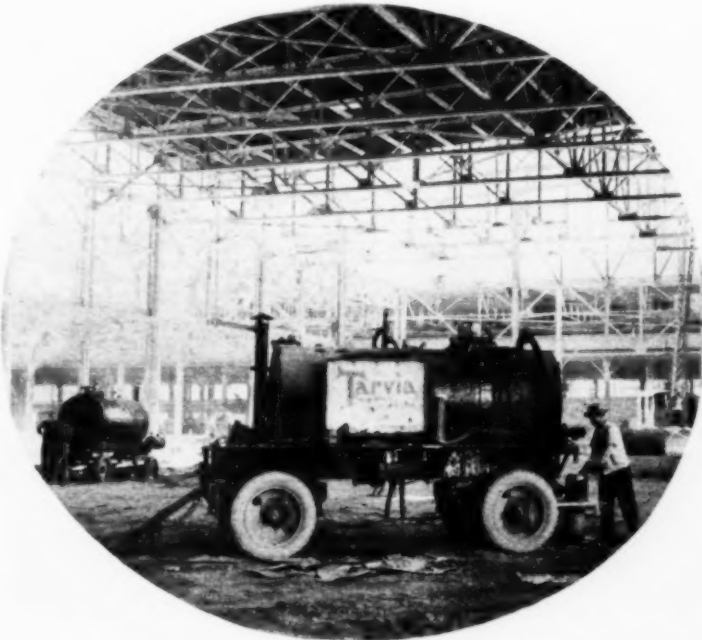
PLYWOOD TEMPLATES perforated to pipe sizes hold conduits in position for concreting at columns.

ploy in it 60,000 men on a two-shift basis. Parking fields for 20,000 cars are included in the layout, and the Michigan Highway Department, with the aid of defense road funds, already has started construction of divided multiple-lane arteries which will be separated at intersections by three-level bridges in the vicinity of the bomber plant.

The main building is 3,120 ft. long by 700 ft. wide with a wing 580 ft. in width projecting 500 ft. to the north at the west end of the structure. A main assembly section 2,800 ft. long by 700 ft. wide includes two 150-ft. clear-span bays 2,800 ft. in length for major assembly and final assembly of big air frames for Consolidated B-24-D bombers. Minor assemblies of parts for the bomber air frames are to be made in a sub-assembly area 2,800 ft. long and 240 ft. wide, comprising four 60-ft. clear bays.

All of the remainder of the building, including the wing

(Continued on page 86)



HEATED TANK TRAILER supply hot pitch to roofing crews using about 20 tons per day.



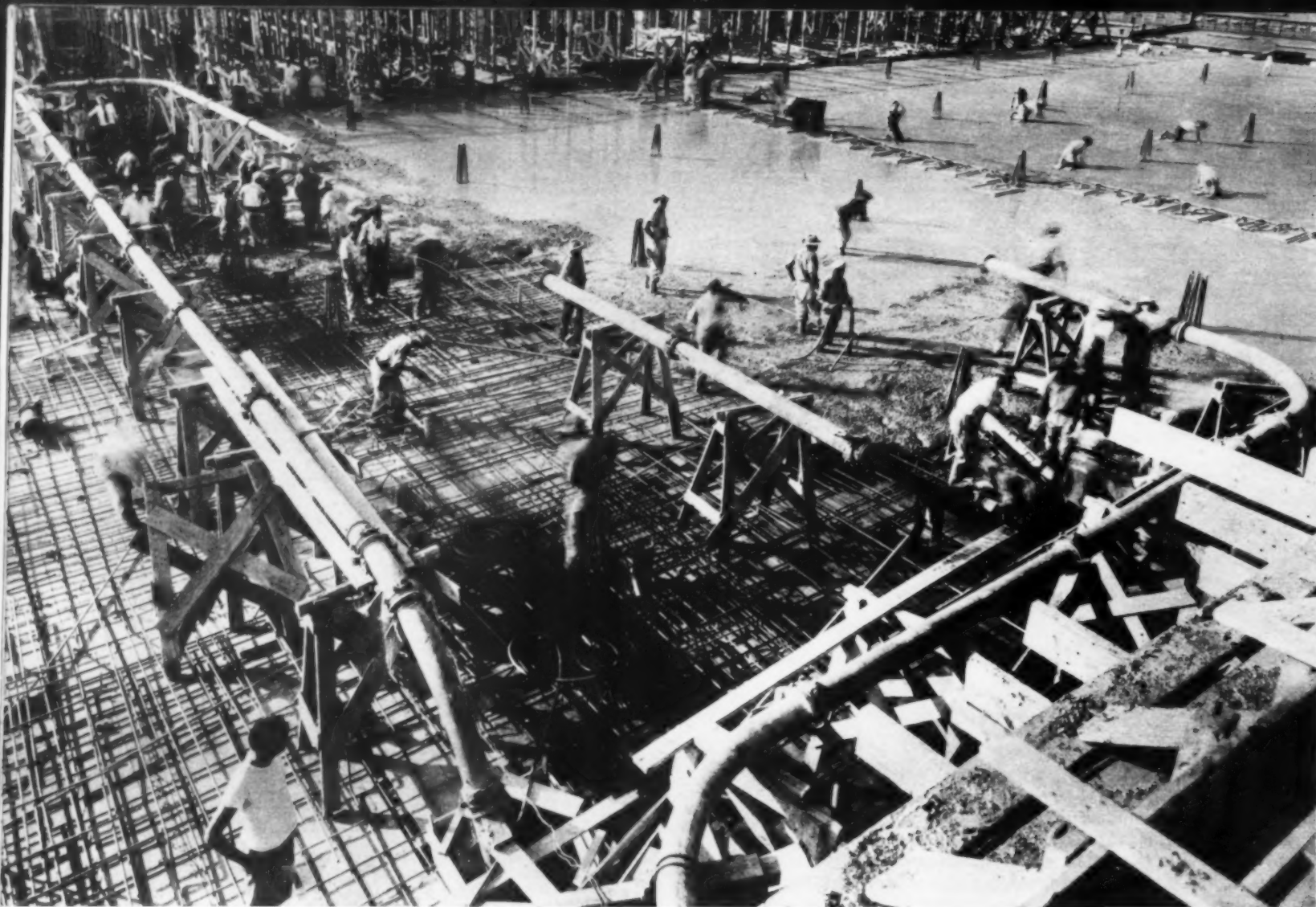
WITH GROUNDWATER SEEPAGE trapped by tile drains in gravel-filled trenches on clay bench of excavated banks, construction of Couse & Sanders' sewage plant job proceeds under dry conditions.



RIB METAL DECK PANELS of 16-gage enamel-dipped steel are laid on roof purlins by crew of Capital Erection & Welding Co. Welder tacks each panel to purlins and later spot-welds overlapping lower edge to under sheet at center of every arch between ribs.

FOUR-PLY BUILT-UP ROOFING (below) is applied by Arrow Roofing & Sheet Metal Co. over 1½-in. vermiculite insulation, which comes to job in 18x36-in. sheets wrapped eight to a package.





EIGHT-INCH PIPE LINES, of 700 ft. maximum length and 60-ft. vertical lift deliver pumped concrete to 20 acres of floor area in 975x200-ft., four-story warehouse at Philadelphia Quartermaster Depot.

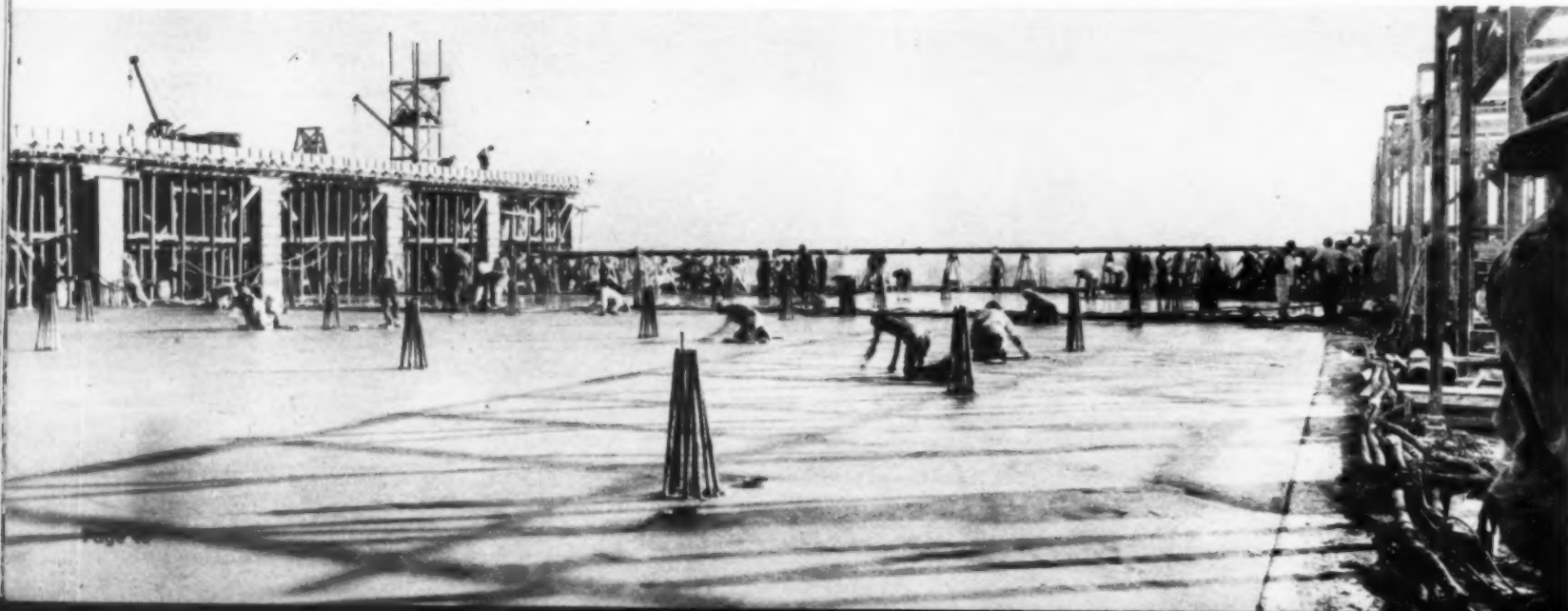
Pumped Concrete

FORMS 20 ACRES OF FLOORS FOR ARMY WAREHOUSE

By **Y. W. NAKANO**
Secretary and Chief Engineer,
Wark & Co., Builders, Philadelphia, Pa.



CLEAR FLOOR AREA (below), unobstructed by runways for concrete buggies, is made possible by pumping concrete to place through 8-in. pipe lines having maximum length of 700 ft.



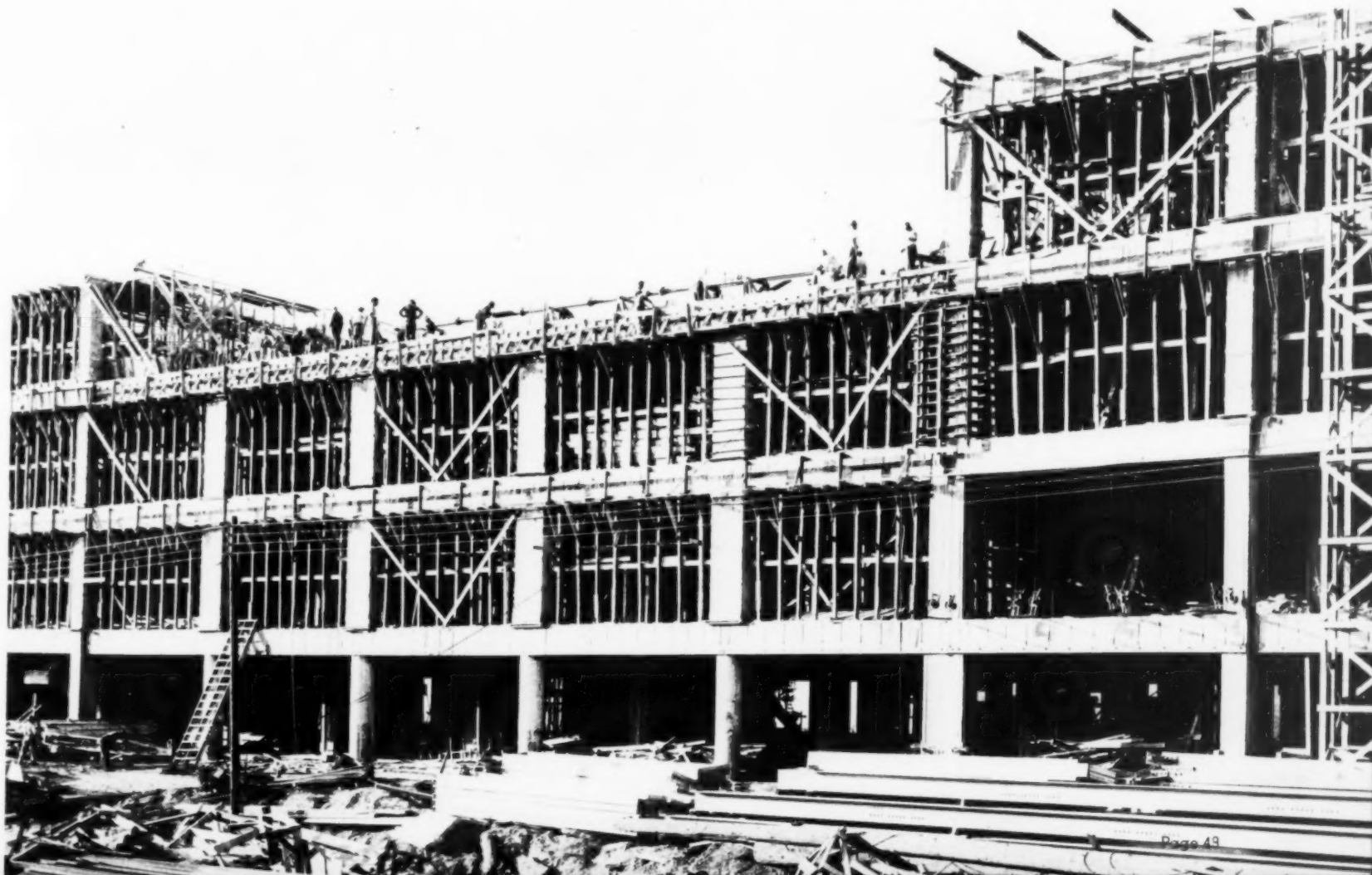
MAINTENANCE OF A 100-CU.YD.-PER-HOUR RATE in the delivery of concrete over an area of 20 acres of floor slabs for a huge four-story warehouse at the Army's Quartermaster Depot in Philadelphia, Pa., was the key factor in determining the methods and the equipment that would enable the contractor to complete the project within a scheduled time limit of only 23 weeks (May 3-Oct. 11). With a length of 975 ft. (thirty-nine bays of 25 ft.) and a width of 200 ft. (ten bays of 20 ft.), the building required a total of 52,000 cu.yd. of concrete and 4,000 tons of steel reinforcements in its concrete frame and 10-in. thick floor slabs. To meet these requirements of rapid and widely dispersed concrete placement on a large scale, Wark & Co. of Philadelphia, operating under a negotiated contract with the Quartermaster Corps amounting to about \$13,250,000 (which included a number of concrete buildings other than the big warehouse forming the subject of these notes) decided upon a plant set-up for pumping concrete to place through pipe lines having maximum horizontal lengths of 700 ft. and vertical lifts of about 60 ft. The finishing of the poured concrete floor slabs was expedited and overtime wages minimized by the use of vacuum mats which removed excess water from the mix in the floor forms.

The warehouse, of reinforced concrete frame and flat slab design, is divided into three sections by transverse brick fire-walls and expansion joints. The outside walls are faced with



TWO-CONCRETE PUMPING UNITS, each with capacity of 60 cu.yd. per hour, are supplied by pair of 6-cu.yd. receiving hoppers fed with ready-mix concrete delivered from ramp by truck-mixers.

FOUR-STORY WAREHOUSE (below) of reinforced concrete flat slab design is 975 ft. long (39 bays of 25 ft.) and 200 ft. wide (10 bays of 20 ft.) with floor area of about 20 acres.





VACUUM MATS are applied to surface of freshly poured floor slabs to remove excess water and expedite finishing operations.

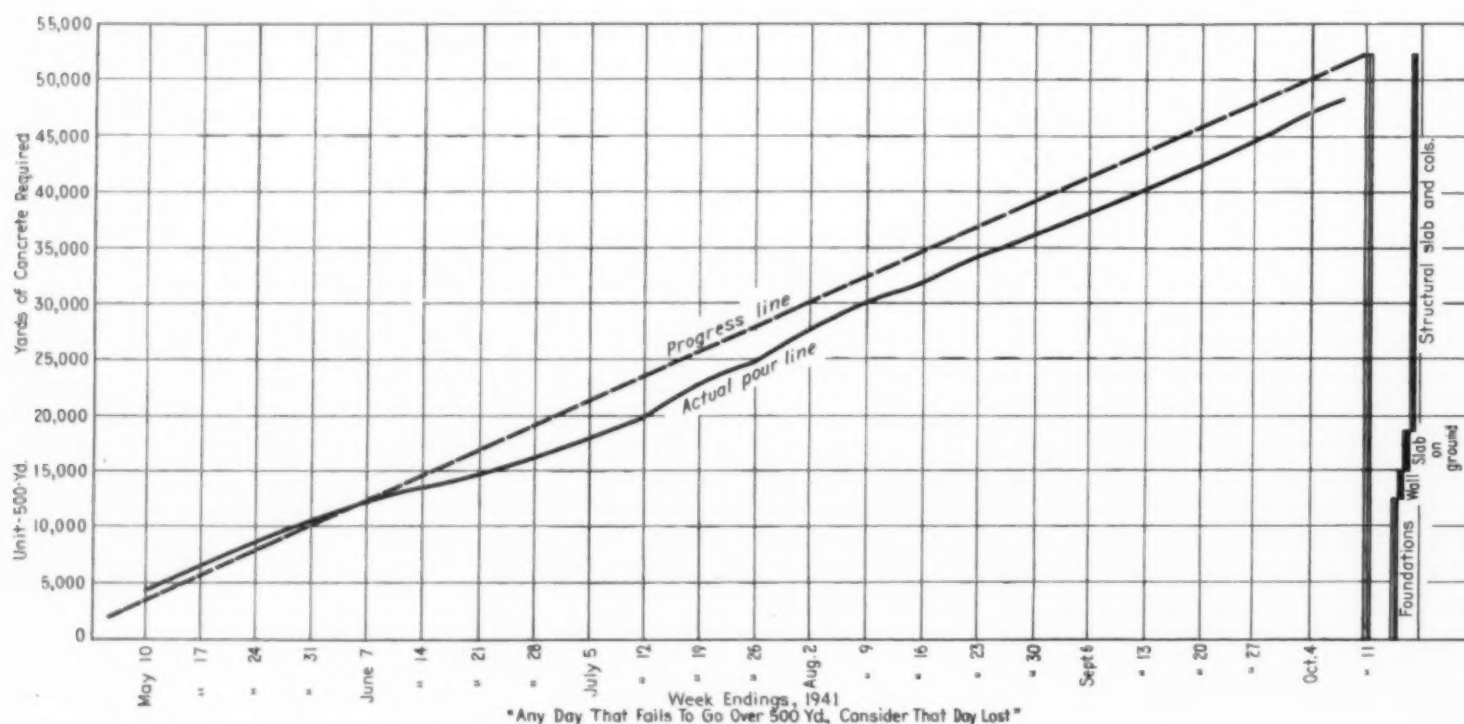
buff brick. All floors of the four-story structure (with a basement under one-third of the ground area) are served by ramps of the scissors type, located in the center of the middle unit. The first bay of the ground floor for the entire 975-ft. length of the building along a railroad siding is left open as a loading platform. Except for the first floor slab, 12 in. thick and designed for a live load of 400 lb. per sq.ft., over the basement area, all other structural floor slabs are 10 in. thick and designed for a live load of 250 lb. per sq.ft.

Most of the foundations in the first unit of the building, where the basement is located, are supported by concrete piles, as the ground there is fill of variable depth. The remaining foundations are on natural soil of excellent hard clay or gravel. Pouring of concrete at or below ground level was done by buggies on runways or directly by truck-mixers where the forms were accessible for the use of this equipment.

Progress Chart—The progress chart (reproduced herewith) prepared for the benefit of the field organization,

which operated on an 8-hour day and 5-day week schedule, called for the pouring of an average of 2,250 cu.yd. of concrete each week in order to meet the required completion date. To insure utmost economy of operation undue overtime was rigidly discouraged, so that plans for double or triple shifts on a 6-day week were completely abandoned. To keep pace with the concreting progress schedule, as charted before the job started, it was necessary, each week, to build and place 45,000 sq.ft. of forms,

(Continued on page 104)



PROGRESS CHART, based on 8-hr. day and 5-day week, called for pouring average of 2,250 cu.yd. of concrete each week to meet completion date. Chart for guidance of field force carries legend: "Any day that fails to go over 500 yd., consider that day lost!"

Job oddities

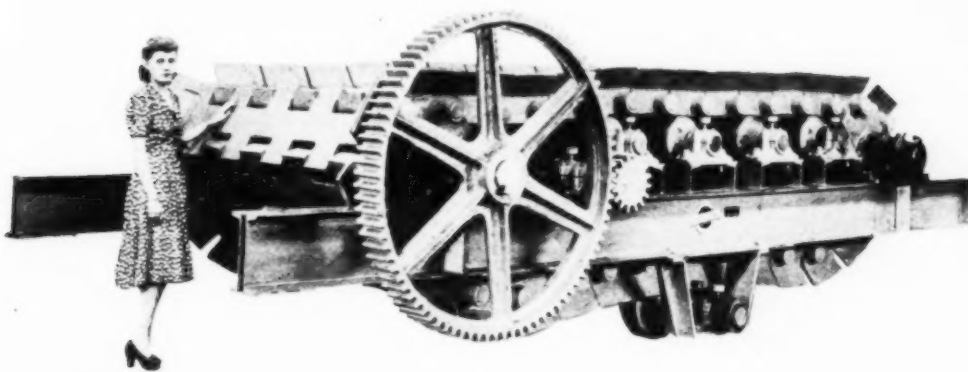


WITH CLEARANCE TO SPARE automobile of Department of Water and Power of Los Angeles, Calif., passes through section of 10-ft.-diameter steel pipe installed on Soledad siphon line.

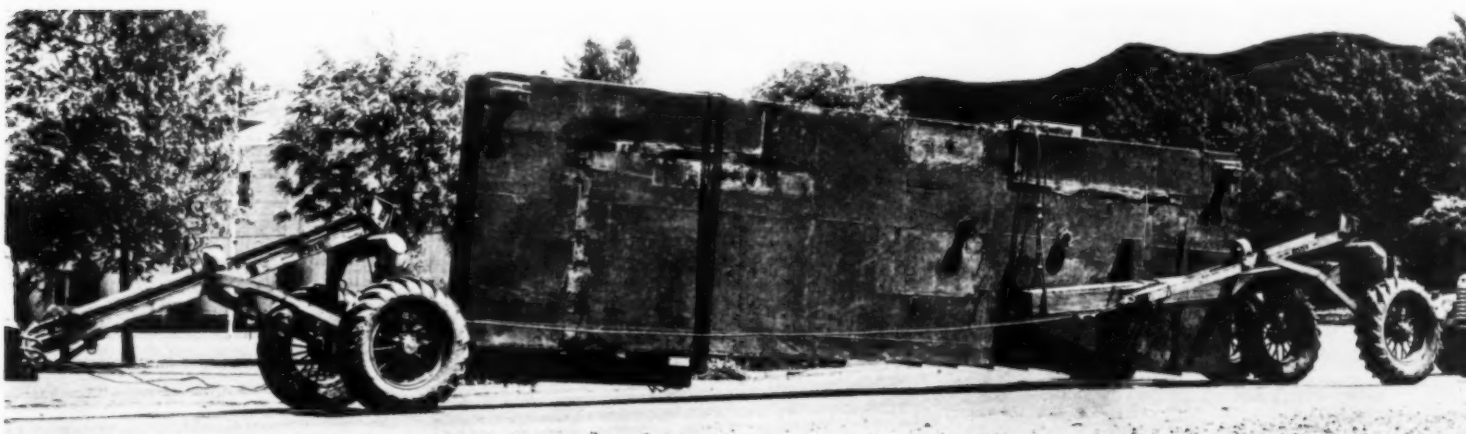


Wide World Photo

SHATTERPROOF WINDOWS of flexible acetate, shipped from United States by British War Relief Society, are being installed in hospitals in England instead of glass to reduce hazards of injury by fragments of broken panes during bombing raids by German planes.



ENORMOUS ROCK FEEDER (left) weighing 39,000 lb., to serve heavy-duty jaw crusher, is shipped by Smith Engineering Works, Milwaukee, Wis., to Canal Zone where it will be important unit of plant setup for building new locks for Panama Canal. Feeder is 6 ft. wide, 12 ft. long and carries rock as it comes from quarry to 66x84-in. Telsmith jaw crusher. Unit will produce concrete aggregate at rate of several thousand tons per day.



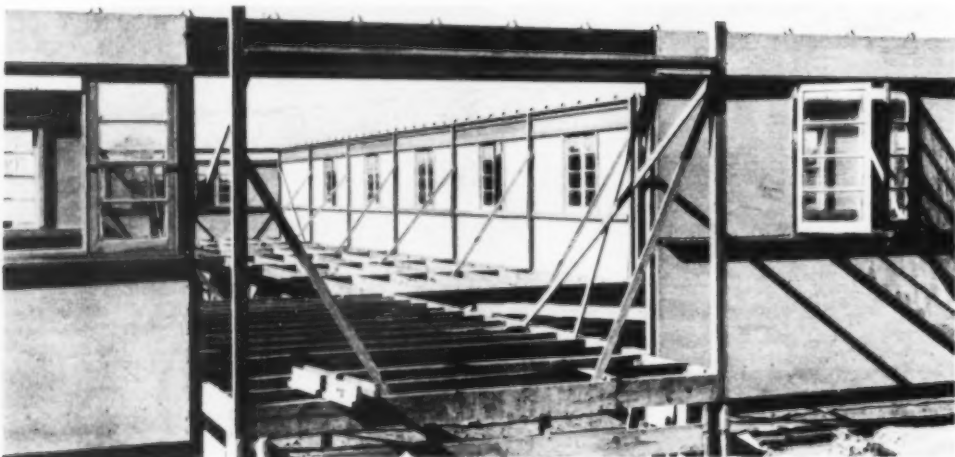
OUT OF ITS ELEMENT on state highway is this steel barge removed from Columbia River at Grand Coulee Dam in Washington and cut in two by oxy-acetylene torches so that halves could be transported in upright position to point where valuable steel of hull will be salvaged. Load is carried by trailer rig consisting of three pneumatic-tired Hyster units.



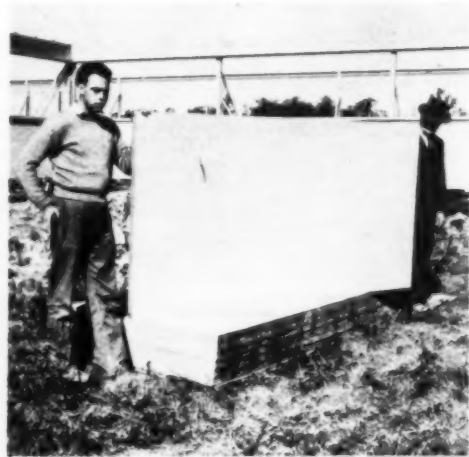
CONSTRUCTION of eight dormitory buildings at Ravenna, Ohio, is directed for Housing Engineering Corp., Baltimore, by REED O'MEARA (wearing hat), superintendent, assisted by DOUGLAS GOODWIN

Horizontal Single-Wall Design

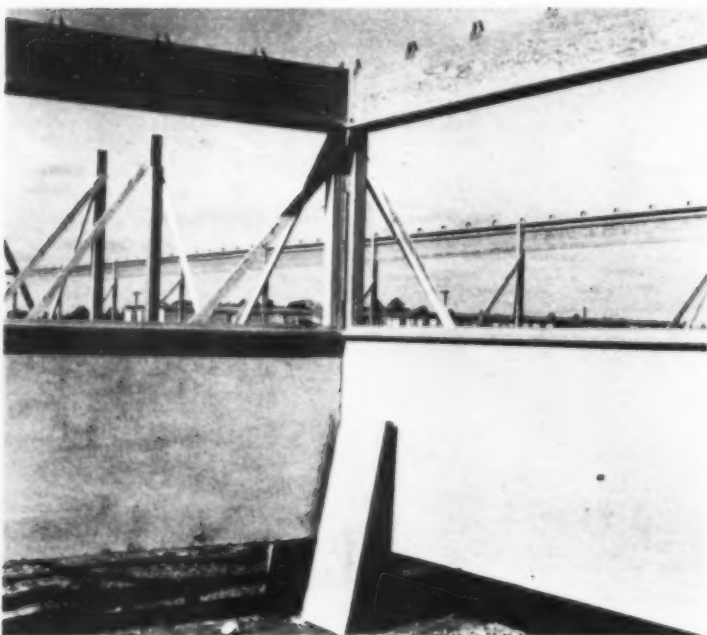
Expedites Site Assembly of Economical Defense Housing



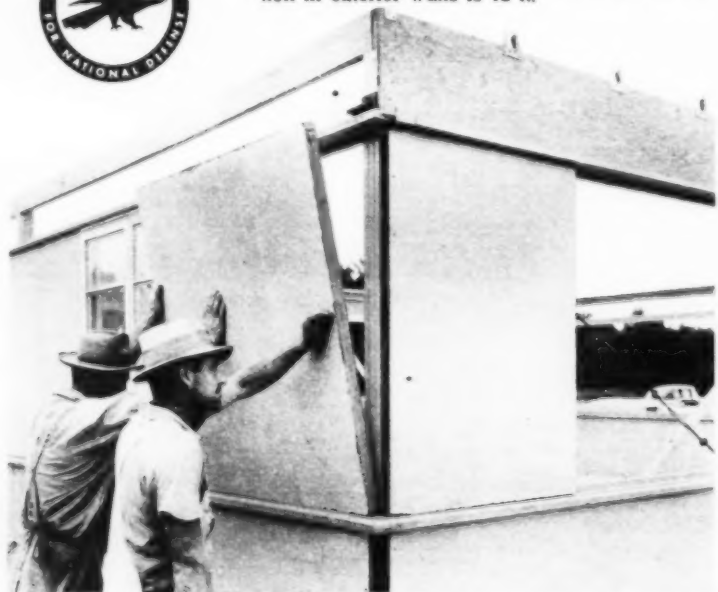
HORIZONTAL DESIGN for single-story building utilizes 4x4-in. timber columns on 12-ft. centers supporting pre-glued and pressed plywood girders to take roof load. Exterior walls are inclosed with single 1 3/4-in. thickness of weatherproof insulating board covered on two sides with asbestos-cement coat providing satisfactory surface both for outside exposure and for interior finish.



WALL PANEL comprising 1 1/2-in. compressed cellulose core covered on both sides with 1/8-in. layer of asbestos cement is pre-cut at mill to exact dimensions for field erection. Panels are 4 ft. high for erection in two courses in exterior walls, and edges which meet at construction joints are given vapor seal treatment before leaving manufacturing plant. This panel is 8 ft. long; standard panel length for lower-course construction in exterior walls is 12 ft.



PLYWOOD GIRDER. built up at mill by glueing and pressing with top plate and bottom girt to form rough channel section, possesses sufficient strength and rigidity to carry load of roof trusses between columns on 12-ft. centers. Metal hurricane clips for roof trusses are in place.



LIGHT-WEIGHT WALL PANEL. mill-cut to exact size, is set and nailed by hand on housing project. As 1 3/4-in. board weighs only 4.9 lb. per square foot, even largest 4x12-ft. panels can be erected by hand without difficulty.

EIGHT DORMITORIES erected at Ravenna, Ohio, by the Housing Engineering Corp., Baltimore, for the Farm Security Administration to house women employees of the Ravenna Ordnance Works exemplify the criteria of economy and practicability which guided the John B. Pierce Foundation and its consulting architects, Skidmore, Owings & Merrill, New York City, in developing design features and assembly practice for the horizontal, single-wall construction patented by the Pierce Foundation and applied to the dormitory buildings under a licensing agreement. In the dormitories and in other housing built in accordance with the patented method, the framing consists essentially of 4x4-in. timber exterior columns on 12-ft. centers carrying a glued and pressed plywood girder which supports job-fabricated wooden trusses spanning a 24-ft. clear bay in which non-load-bearing partitions may be positioned as desired.

Exterior walls are inclosed by a single 1 3/4-in. thickness of weather-resistant Cemesto insulating board erected in large panels, ordinarily 12 ft. long by 4 ft. wide. For roof covering, the construction employs large interlocking Celo-Roof panels attached directly to the rafters; the panels combine the three essential properties of sheathing, insulation and roofing.

Identical construction previously had been applied by the Housing Engineering Corp. at Middle River, Md., in erecting five FSA dormitories for men workers in the Glenn L. Martin aircraft plant, and the same principles of patented horizontal, single-wall construction had been followed by a Martin subsidiary in building 607 single-family residences for employees in the vicinity of the plant. Costs as low as \$2,250 for a five-room dwelling, in combination with erection speed and the serviceability and livability of the houses, had dem-

onstrated practical advantages for this type of construction in housing.

For the single-wall design developed by the John B. Pierce Foundation, Cemesto board manufactured by the Celotex Corp. offered the requisite combination of qualities for use as siding, insulation and interior finish on an experimental house erected by the Foundation in May, 1940. Having decided on this type of board for wall covering, the Foundation and its consulting architects took the next logical step of concentrating orders for other needed materials to as great extent as possible with the same manufacturer. A thinner Cemesto board, 1 1/4 in. thick, is used for interior partitions, Celotex key-joint pre-finished panels are applied to the ceilings, and Celo-Roof panels shop-covered with 90-lb. roofing felt are laid on the rafters to form the roof.

Wall Board—The 1 3/4-in. board for the exterior walls comprises a 1 1/2-in.



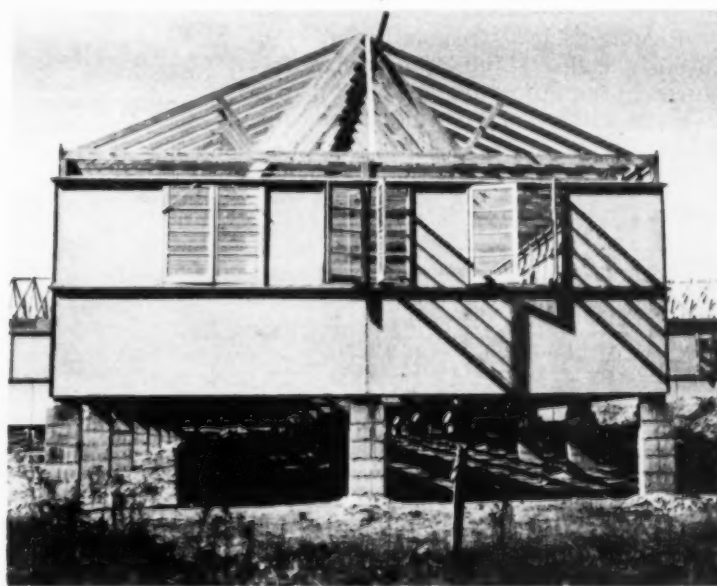
INTERLOCKING FEATURE of composite roofing board consists of tapered upper edge which fits into groove of head lock under 3-in. overlap at lower edge of next higher course. Butting edges of adjacent panels in same course are interlocked by overlapping 90-lb. roofing felt which covers pressed fiber insulating core of panels.



ROOF TRUSSES made up of job-cut and job-notched members are assembled on jig table in accordance with complete details shown in construction plan. These plans are so clear and comprehensive that little waste or lost motion can occur on job.



ROOFING PANEL has overall length of 7 ft. 1 1/4 in. and overall width of 16 in., with 13-in. exposure. Each panel is attached to roof rafters with six nails at upper edge only; driving of these nails tends to tighten interlock at lower edge, producing rain-tight and wind-tight roof. Note strip of 90-lb. roofing felt to seal butt joint between adjacent panels.



END WALL of dormitory wing has calked construction joint in center of lower course of siding, where two 4x12-ft. panels meet. This joint will be covered by asbestos-cement batten. Horizontal construction permits insertion of windows at any place in upper course of wall inclosure. Roof trusses supported on outside girders bridge 24-ft. clear span across building. No built-up girder is required in end wall, which carries no roof load.

core of compressed bagasse fiber covered on both sides with a $\frac{1}{8}$ -in. layer of asbestos cement applied on top of a bitumastic coat. The asbestos-cement covering material is applied in the form of a wet sheet looking like water-soaked cardboard and is pressed on to the bitumastic-coated fiber core to produce a durable bond. After this pressure treatment, the panels are stored for a sufficient time to permit curing of the asbestos-cement cover. Edges which meet at construction joints are given a vapor seal. A 12x4-ft. wall sheet $1\frac{3}{4}$ in. thick weighs 235 lb. It is set in place by manpower without the use of any mechanical equipment.

Tests of Wall Panels

Moto-Homes, dwellings of a type developed and erected in the early 1930's by American Houses, of New York City, with the active support of the General Electric Co., employed a single thickness of Cemesto board in the exterior walls. These walls are still giving complete satisfaction after 8 to 10 years' occupancy of the houses. As part of the research and development work of the Pierce Foundation and of the consulting architects, the wall board has been subjected to an extensive series of laboratory tests to determine its imperviousness to moisture and its strength and rigidity under wracking and compression. The board has passed all these tests with results that greatly exceed the requirements for a closure material to be used in single-wall construction.

Laboratory tests have established a high insulating value for Cemesto board and have given the $1\frac{3}{4}$ -in. panel a low heat transfer coefficient of 0.19, equivalent to a built-up wall of the following composition: 4-in. brick veneer plus 1-in. air space plus $\frac{3}{8}$ -in. rigid insulation plus 4-in. studding with intermediate air pockets plus $\frac{1}{2}$ -in. insulating lath and plaster.

Roofing panels, frequently but erroneously called shingles, are manufactured in the proper dimensions to cover a house without any cutting at the ridge

(Continued on page 109)



ON CONCRETE BLOCK PIERS spaced 12 ft. c. to c., in both directions, carpenters construct floor framing of transverse girders carrying longitudinal floor joists on 24-in. centers.



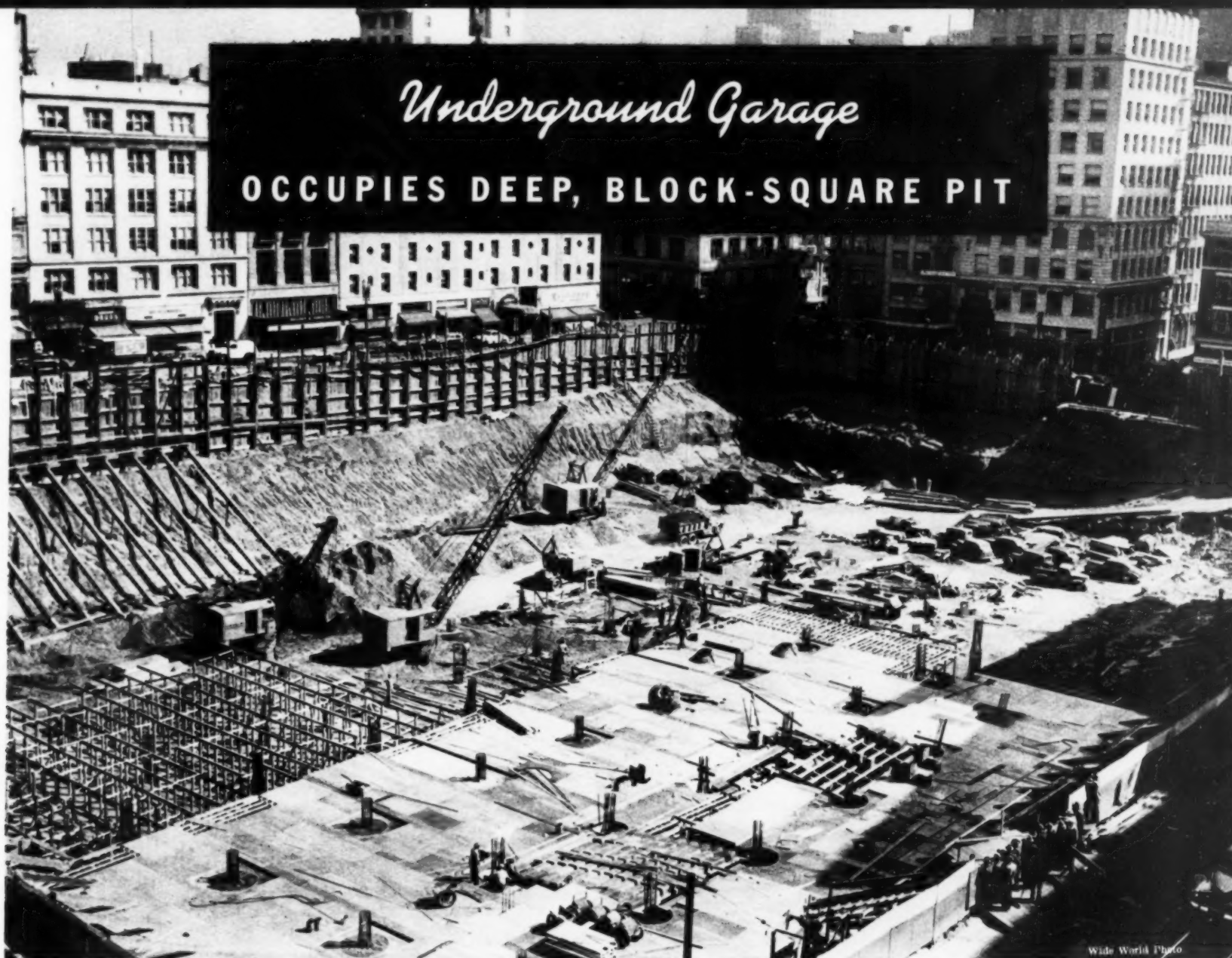
ROUGH LUMBER is ordered in stock lengths and is cut on job at saw table equipped with three Walker-Turner 2-hp. electric radial saws. Lumber waste is small, as indicated by scrap pile at right.



YARD CARPENTERS fabricate floor girders and attach ledgers and stirrups to carry joists.



HORIZONTAL GIRT separates lower and upper courses of wall panels and provides sill for windows. Girt is temporarily attached to columns during erection of building frame but is finally supported by lower course of panels after they have been nailed in place.



EXCAVATION, 48 FT. DEEP, is made for block-square garage in San Francisco. Forms for third floor below street level are being erected. Note diagonal braces that support bulkheading at side of pit.

A DEEP EXCAVATION in downtown San Francisco for a four-story underground garage called for ingenuity in bulkheading the sidewalls to prevent settlement in the adjoining streets. The garage, which will provide parking space for 1,700 cars, occupies the entire 275-412-ft. city block known as Union Square, a city park.

As soon as excavation started, the contractor began to put down steel I-

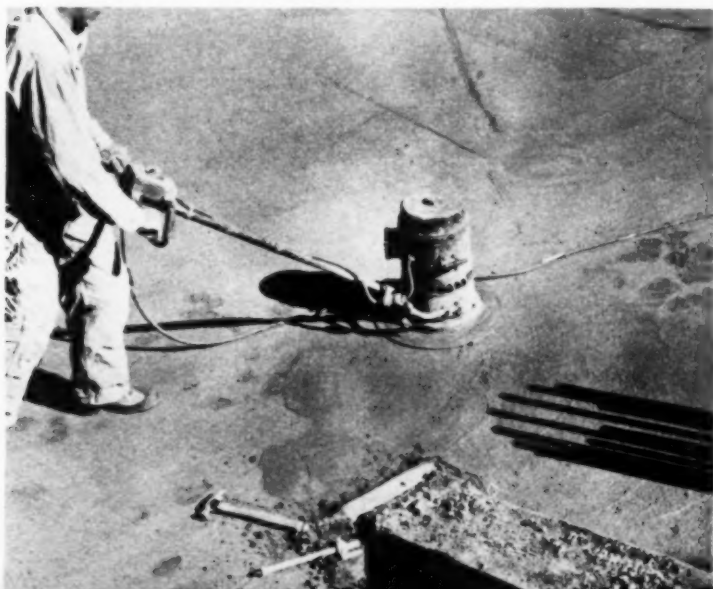
beams on 8- to 9-ft. centers all around the edges of the excavation. These steel "piles" were prevented from bending inward, as the cut deepened, by inclined braces of 12x12-in. timbers whose lower ends were set against the concrete pier footings for interior columns. These footings were poured in excavations of small area that were carried down to full depth at an early stage of the operations. Along one side of the excavation,

where seepage water was encountered, the inclined braces were tied down with steel rods to prevent the vertical component of the thrust from lifting them.

Behind the protection of the bulkhead, excavation was carried on successfully. The material removed was chiefly sand which could be trucked out readily over an access ramp leading up to the street. The steel piles and their inclined braces

(Continued on page 83)

CONCRETE FLOOR FINISH (below) is done with Kelly surfacing machine prior to final finishing by hand. In immediate foreground is part of inclined 12x12-in. timber that braces bulkhead.



CONCRETE IS POURED (below) in one of mezzanine floors. Ready-mixed concrete is chuted from street level to hoppers serving buggies.





ROADSIDE TREES ARE PRESERVED as screen on division strip in widening U. S. Route 99 south of Madera by California Division of Highways. Existing 20-ft. pavement was supplemented by additional 23-ft. concrete pavement, with separating strip containing row of trees between old and new roadways.

HOW

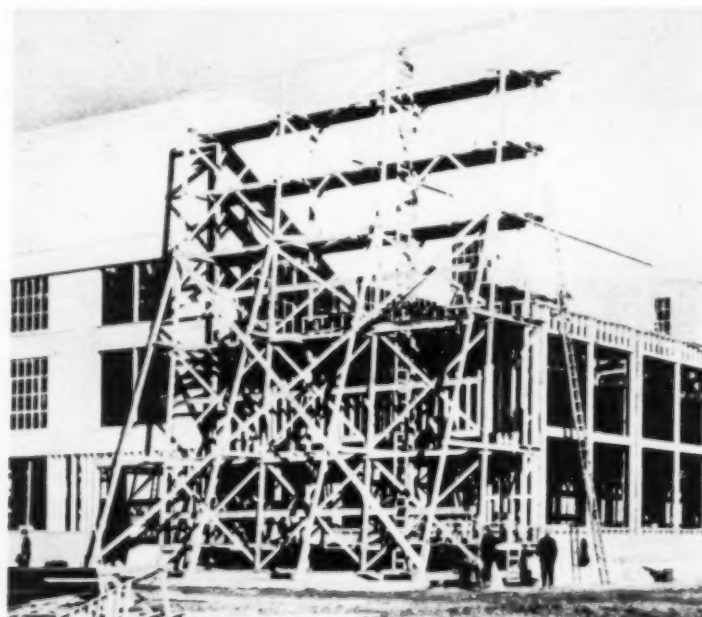
They Did It

CONSTRUCTION DETAILS

*For
Superintendents and Foremen*



FLUSH WATER FIT TO DRINK is delivered to roof tanks above construction offices at Willow Run bomber plant, Ypsilanti, Mich., by Ford Motor Co. in 1,000-gal. wood-stave tank trucks. Centrifugal pump driven by 1/2-hp. electric motor is installed in small lean-to alongside wall of office building to lift water to roof tanks. Wood-stave tanks on trucks are steam-cleaned twice a week to assure cleanliness, as water from these tank trucks is used for drinking purposes on airport being constructed in connection with plant.



MOBILE WORKING SCAFFOLD is mounted on skids for towing by tractor to new locations along walls of new 260x780-ft. wood frame building in British Columbia for manufacture of flying boats by Boeing Aircraft Co., Ltd., of Canada. Scaffold is used for installing exterior walls of plywood and setting window frames.

FOR HANDLING AIRPLANE BOMBS (below) of 500-lb. weight at U. S. Army Air Base, Orlando, Fla., six-cylinder International diesel tractor is equipped with special full-revolving crane boom.

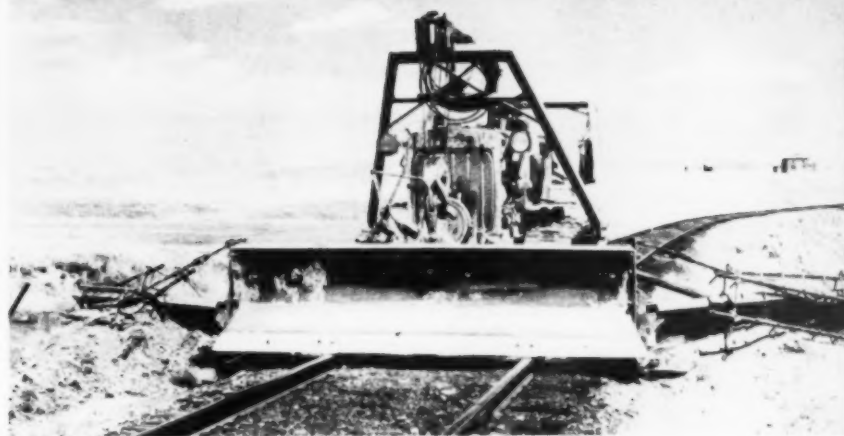


ASSEMBLED ON ROADWAY (below) before being moved into place across San Lorenzo River at Santa Cruz, Calif., wood truss pedestrian bridge of 140-ft. span has 8-ft. walk and is designed for live load of 80 lb. per square foot. Bridge, fabricated with aid of Teco timber connectors by Summerbell Roof Structures, of Oakland, Calif., uses 18,000 b.ft. of Wolmanized pressure-treated Douglas fir from plant of American Lumber & Treating Co., of Weed, Calif.





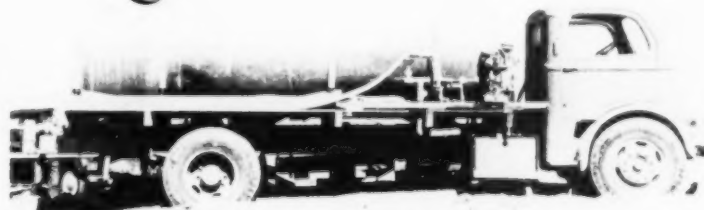
MELTING CAKES OF ICE are used to lower 350-ft.-long section of 30-in.-diameter water main (*above*) to allow for grading and paving new street in Augusta, Ga. Operation was performed without interrupting service. Vertical distances lowered ranged from 2 ft. 3 in. at mid-point to 1 in. at ends. Ice blocks (*below*) were placed under middle of each pipe length and then excavation under bells was completed. Job requiring 3,900 lb. of ice was begun at 9:30 a.m. and completed at 8 p.m. of same day. No leaks occurred. — Photo from JOHN D. TWIGGS, assistant city engineer, Augusta, Ga.



BANK WIDENING ATTACHMENT rigged on Caterpillar diesel tractor enables Morrison-Knudsen Co., contractors, of Boise, Idaho, to level off shoulders of railway embankment built with dragline at Judith Basin near Lewistown, Mont.



TINY GLASS BEADS are applied with yellow paint by Indiana Highway Commission to mark traffic lines that glow at night under approaching headlights of automobiles at "no-passing zones." ReflectORIZED lines are applied by same machine that marks traffic center lines. Glass beads are sprinkled on freshly painted areas by tubes from container.



WATER SPRINKLING TRUCK used ordinarily by Ford I. Twatts Co., contractor, for moistening earth during construction of new airport at Victorville, Calif., is equipped with pump driven by truck motor, thus making outfit useful in fire fighting.

SANDBLASTING (*below*) is employed at Shasta Dam in California to clean surface of concrete and insure bond with next pour. Sand is heated to expel moisture and is kept dry so that it will flow through rubber hose to nozzle where it combines with air pressure jet.



Tunnel Mucking

A Survey of Current Practice Covering Methods and Equipment Used for Removing Blasted Rock

By H. W. RICHARDSON and ROBERT S. MAYO

Associate Editor,
Engineering News-Record

Consulting Engineer,
Lancaster, Pa.

AS ROCK "GROWS," or bulks, when broken, 1 cu.yd. of loose muck does not represent 1 cu.yd. of solid rock. Growth can be assumed as 50 per cent; in other words, 1 cu.yd. of solid rock will make 1½ cu. yd. of muck. The growth of rock varies with the degree of breakage; the actual growth can be found by comparing the weight of a cubic yard of muck with the theoretical weight as calculated from the specific gravity of a sample. Furthermore, over-break always increases the yardage from 15 to 30 per cent. Performance of mucking machines is generally given in

PRACTICAL TUNNEL DRIVING

THE TEXT AND ILLUSTRATIONS of the accompanying article are from a chapter of the book, "Practical Tunnel Driving," by H. W. Richardson and Robert S. Mayo, recently published by the McGraw-Hill Book Co., New York. The 424-pp. volume, profusely illustrated with drawings and photographs, covers in detail all of the fundamental operations of tunneling in both soft and hard ground.

—Editor.

terms of loose rock. It would be better if tunnel men followed mining practice of using the term "tons loaded."

Hand Mucking

Mucking by hand has almost entirely been displaced by the machine except in small or short tunnels; yet almost every job requires some hand mucking until there is room enough to work a mucking machine. A man needs 2½ to 3 ft. of space in which to work. Therefore, a tunnel 10 ft. wide can accommodate not more than four shovelers. Hand mucking is hard work;

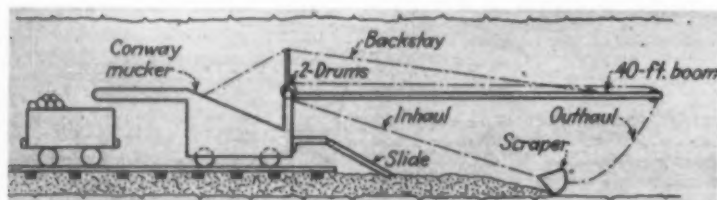


Fig. 1... MUCKER of Conway type is converted to slusher for clean-up of invert by adding a boom, scraper bucket and slide.

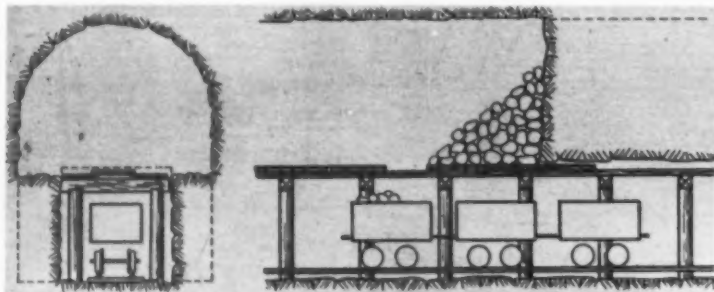


Fig. 2... MUCK IS TRAPPED into cars in bottom-drift method of tunneling.

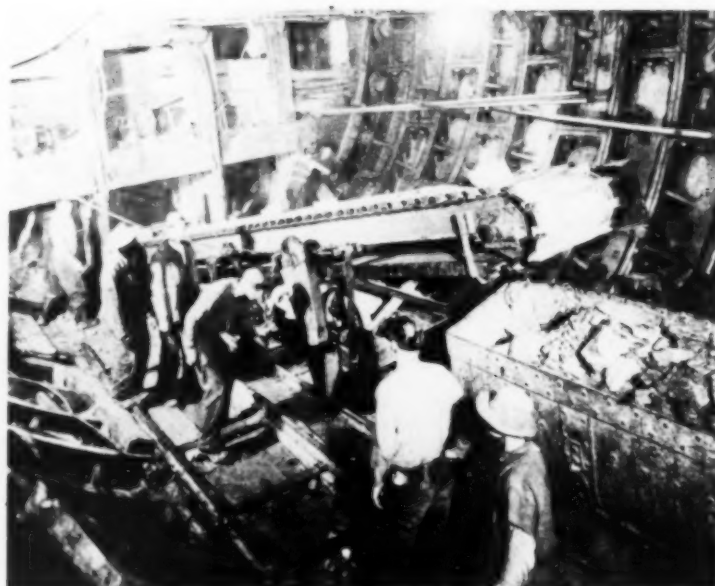


Fig. 3... PORTABLE BELT CONVEYOR loads muck into "battleship" in shield tunnel passing through section of rock, Lincoln Tunnel, New York.

it is desirable to alternate the men on less fatiguing work, such as picking or car-pushing.

Mining Engineers' Handbook cites an example of a small western tunnel where the mucking gang consisted of six men; two engaged in loosening the ground, two shoveling, and two switching cars. After each car was loaded, the men changed positions. A 16-cu.ft. car was filled in 3 to 4 min., a rate of about 9 cu.yd. per hr. or an average of $1\frac{1}{2}$ cu.yd. per man-hour, including lost time.

One man can load about 2 cu.yd. per hour under best conditions but, considering all lost time, the output is generally figured at $\frac{1}{2}$ to $\frac{2}{3}$ cu.yd. per man-hour for every man in the gang.

"Slick sheets" should always be used when hand loading. These are steel sheets generally of $\frac{1}{4}$ - or $\frac{5}{16}$ -in. plate, about 4x6 ft., with a large hole punched in each corner of the sheet for picking up by hooks for moving. The floor of the tunnel is covered with these sheets for 20 ft. back from the face before each shot. This smooth surface materially increases the output in mucking. The cars should be as low and wide as possible to facilitate loading of large pieces.

Cleaning Bottom—The final cleanup of the bottom before the invert is laid (whether the tunnel is concreted invert first or invert last) is usually by hand. The first operation is to distribute empty cars along the track and to clean up

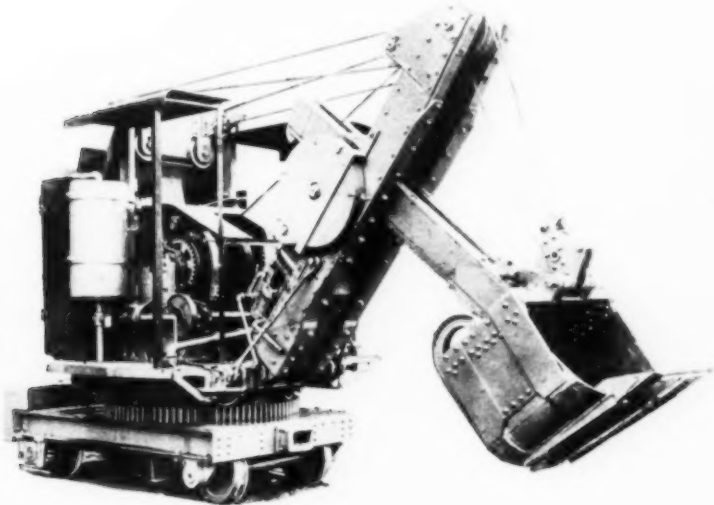


Fig. 5 . . . **AIR-POWERED SHOVEL** of 1-yd. Osgood full-revolving type, is used in mucking out 17-ft. tunnel.



Fig. 7 . . . **CRAWLER-MOUNTED, AIR-POWERED SHOVEL** is full-revolving Bucyrus-Erie unit used on Lincoln Tunnel, New York.

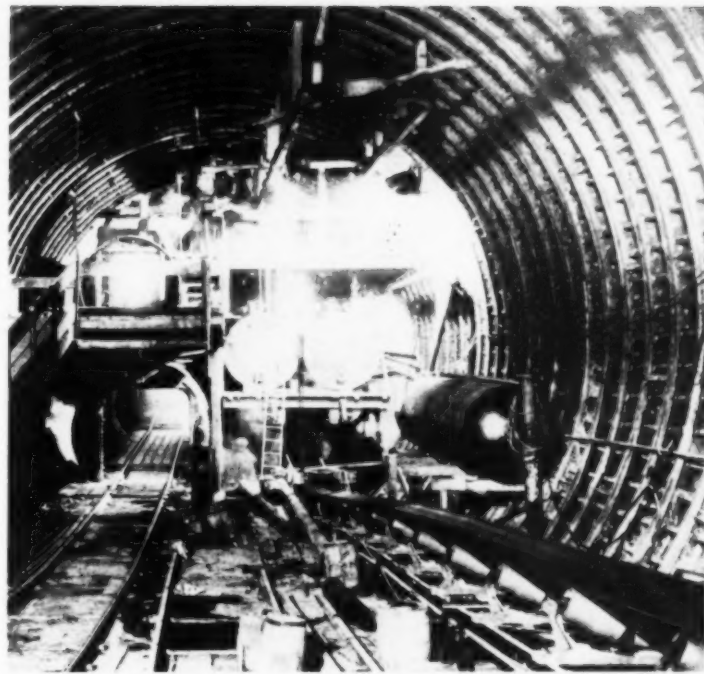


Fig. 4 . . . **BELT CONVEYOR** transports muck from shield through locks to foot of shaft, Boston Harbor Tunnel. Special conveyor arrangement is used in pair of locks.



Fig. 6 . . . **RAIL-MOUNTED TUNNEL SHOVEL**, electric-powered Bucyrus-Erie unit, carries electric-hoist cherry picker on same running gear.



Fig. 8 . . . **CRAWLER-MOUNTED MUCKING MACHINE** is Nordberg full-revolving air-powered unit, used on Chicago sewer tunnels.

TRU-TRACTION



Tru-Traction is power on
both tracks at all times



MODEL FD CLETRAC — 96 DR

plus Electric *STARTING*



Tru-Traction and Electric Starting are two features that are enabling Cletracs to speed National Defense Projects to rapid completion. Tru-Traction (power on both tracks at all times) enables you to get the job done faster and more economically. Faster—because with Tru-Traction steering, you can maneuver and spot your loads where you want them—without frequent stops to shift gears.

Today, when every minute counts, you will find that Cletracs will give you more working time—less lost time—because Cletracs are engineered and built to save time. All Cletrac Diesels have Electric Starting (standard equipment). No delays in getting the job started—just a touch of the button and you're ready to go.

Operators everywhere are running their machines to capacity—taking almost unbelievable loads. But—once in awhile—operators will dig too deep and sometimes engines are stalled. With Cletrac on the job, your power is there again at the touch of a button. No need to dismount—no need to lose time that is becoming more and more vital to the Defense of America.



THE CLEVELAND TRACTOR COMPANY
CLEVELAND, OHIO

CLETRAC CRAWLER TRACTORS

14 to 96 Horsepower

Gasoline or Diesel

DRAWBAR H.P. HEIL BULLDOZER



Fig. 9 . . . **AIR-POWERED TUNNEL MUCKER** on Olmstead Tunnel, Utah, is Einco rail-mounted machine discharging overhead to rear. Here it is discharging into belt conveyor hopper, but it usually loads into cars.

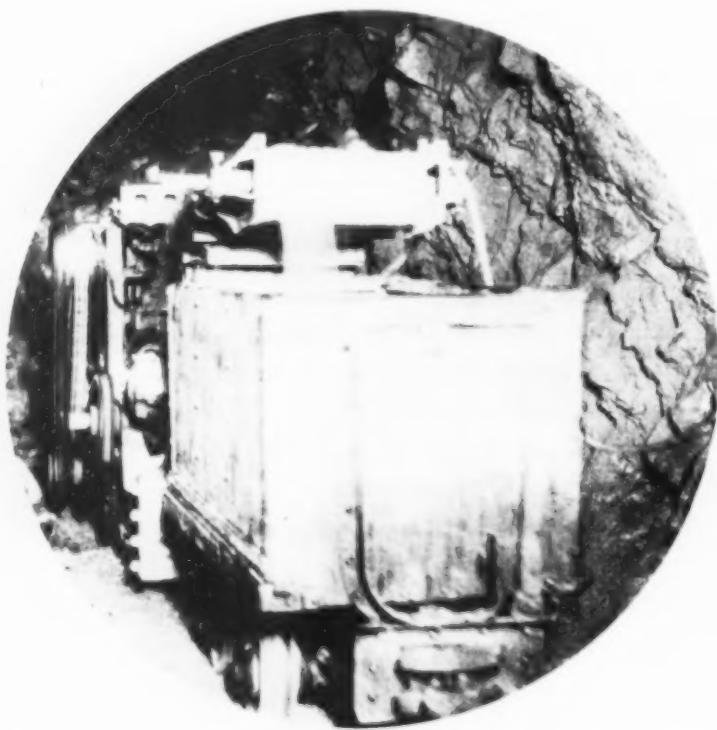


Fig. 11 . . . **REAR VIEW** shows Conway Mucker loading car. Car is coupled to mucking machine and travels with mucker as it moves back and forth to crowd and load.

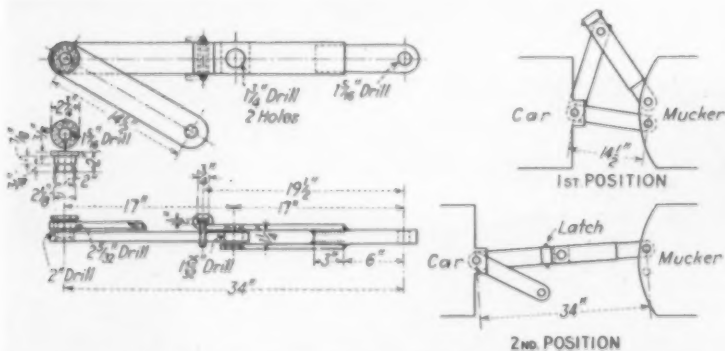


Fig. 12 . . . **COUPLER** on Conway Mucker. Short connection is used first for loading rear end of car. Then long connection is used while loading front end.



Fig. 10 . . . **RAIL-MOUNTED MUCKER** is Conway machine with tip-up discharge on to belt conveyor loader forming part of machine. This mucker is air- or electric-powered.

all the muck in the ditches and between the ties. The track is then torn out and the muck under the ties end-loaded into a muck car. This is an excellent spot for belt conveyors, one inclined conveyor filling the car and a horizontal conveyor into which the men shovel. The inclined conveyor may be wheel-mounted, the wheels straddling the muck track so that the rails and ties can be removed without delaying the muckers. On one job where this system was used an output of $1\frac{3}{4}$ cu.yd. per hour for each shoveler was recorded, including time lost changing cars.

Sometimes it is possible to throw the track over to one side while half the floor is being cleaned, then shift the track to the other side. This method is particularly desirable when the invert is being concreted in half widths, for the muck track is available for concrete delivery.

(Continued on page 74)

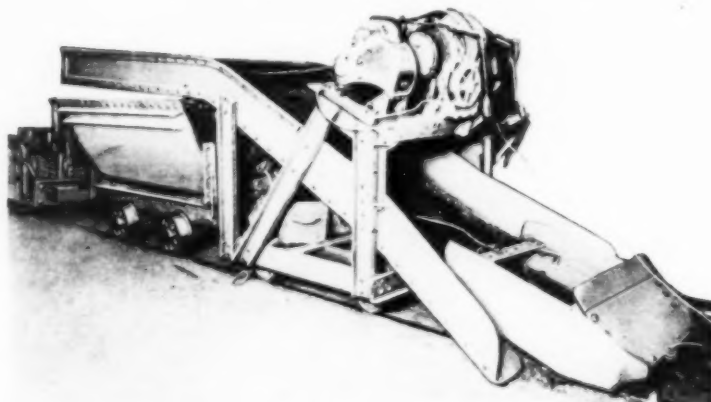


Fig. 13 . . . **SLUSHER OR SCRAPER** type of muck loader is Sullivan machine equipped with two-drum hoist, bottomless scraper and slide at 20-deg. angle.

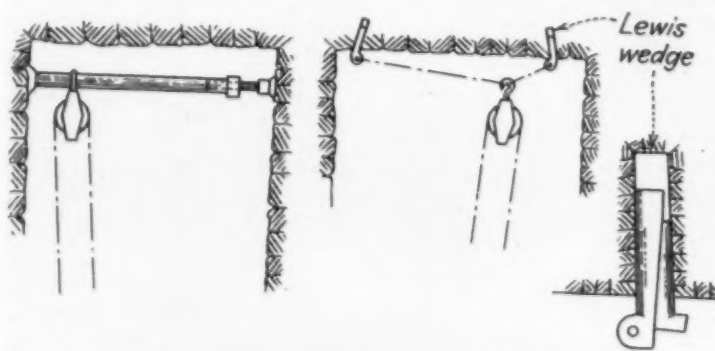


Fig. 14 . . . **METHODS OF ANCHORING** tail block in slusher mucking.

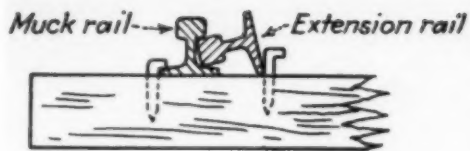


Fig. 15 . . . **TELESCOPING RAIL** extends track near working face.

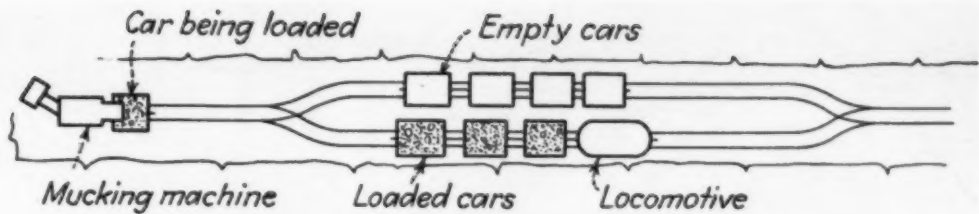


Fig. 16 . . . **PASSING TRACK** provides one method for switching cars.

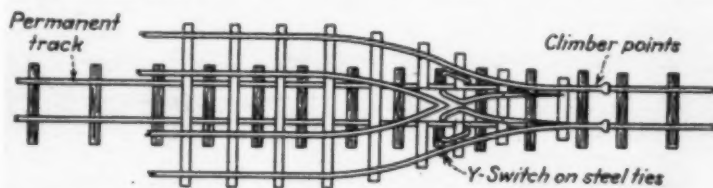


Fig. 17 . . . **ONE TYPE** of California switch for passing cars.

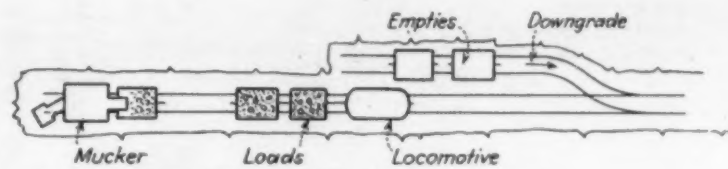


Fig. 19 . . . **SPUR TRACK** for switching cars in tunnel.



Fig. 18 . . . **CALIFORNIA SWITCH** on Montebello water tunnel, Baltimore. Outside tracks are used for passing cars when mucking, but all heavy and wide equipment is hauled over center track. Note spring switches.

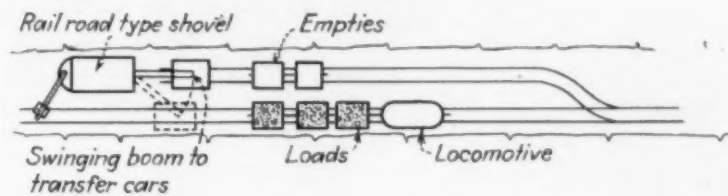


Fig. 20 . . . **CHERRY PICKER** is mounted on shovel for transferring empty cars to loading track.

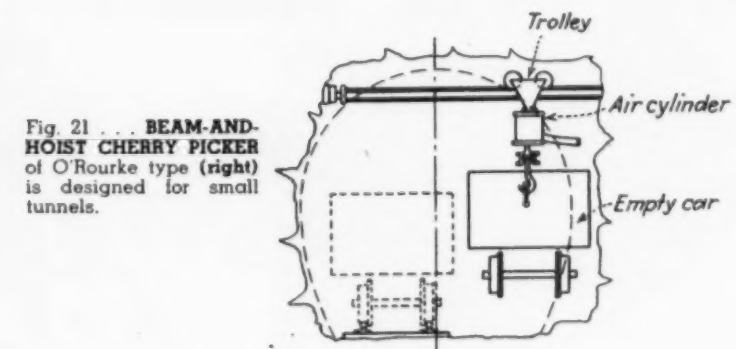


Fig. 21 . . . **BEAM-AND-HOIST CHERRY PICKER** of O'Rourke type (right) is designed for small tunnels.

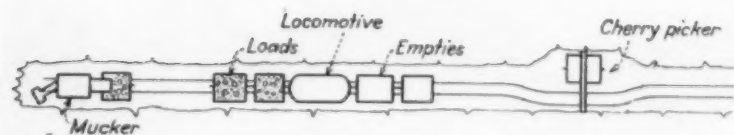
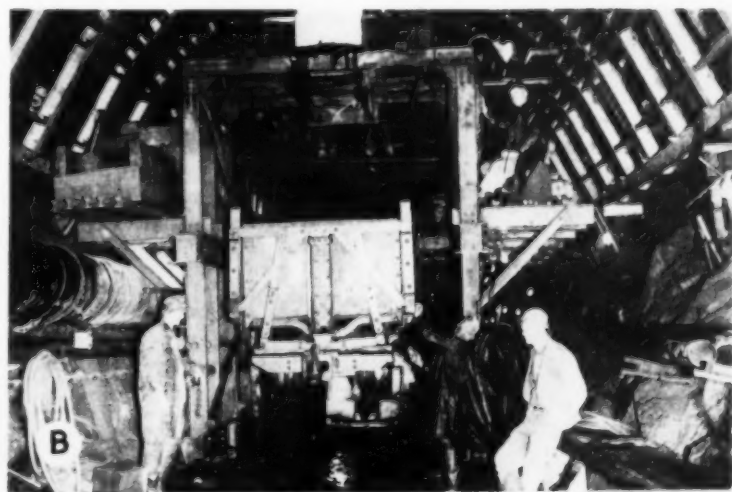
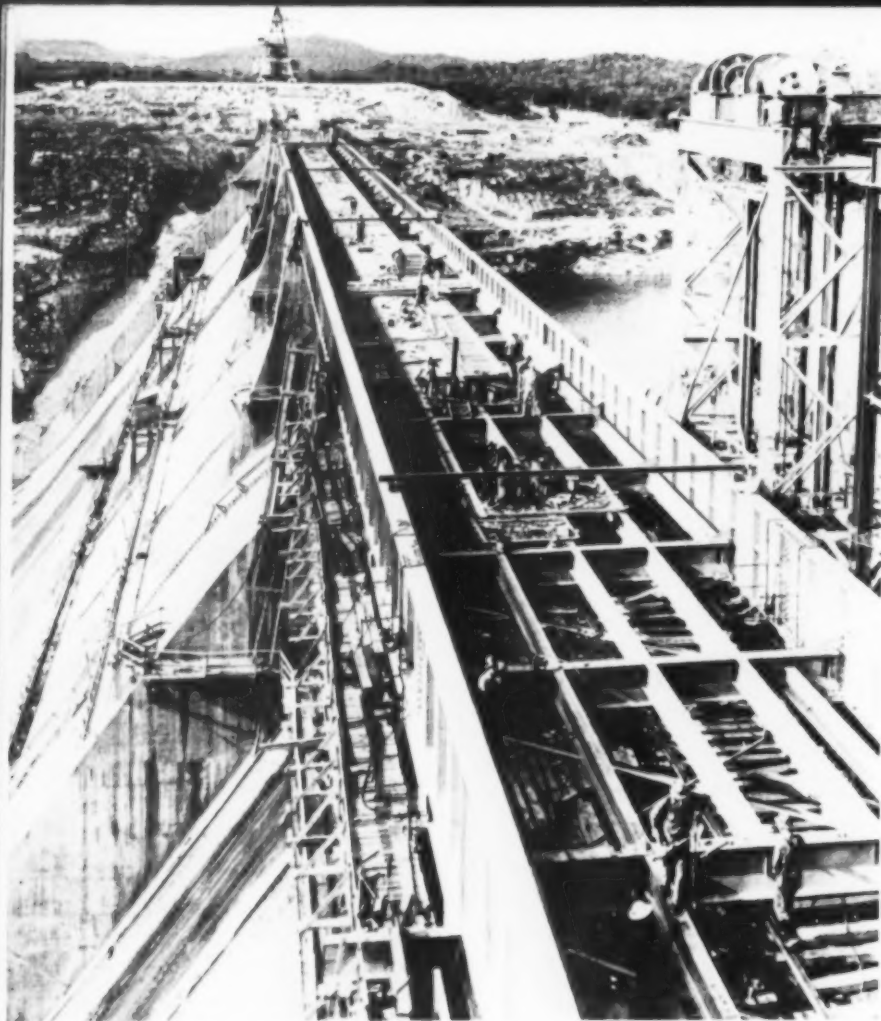


Fig. 22 . . . **OPERATION OF CHERRY-PICKER** for changing cars in muck train.



Fig. 23 . . . **TWO TYPES (A and B)** of vertical cherry picker. These can be used only in tunnels high enough to permit loaded cars to pass underneath, but are suitable for single-track tunneling operations.





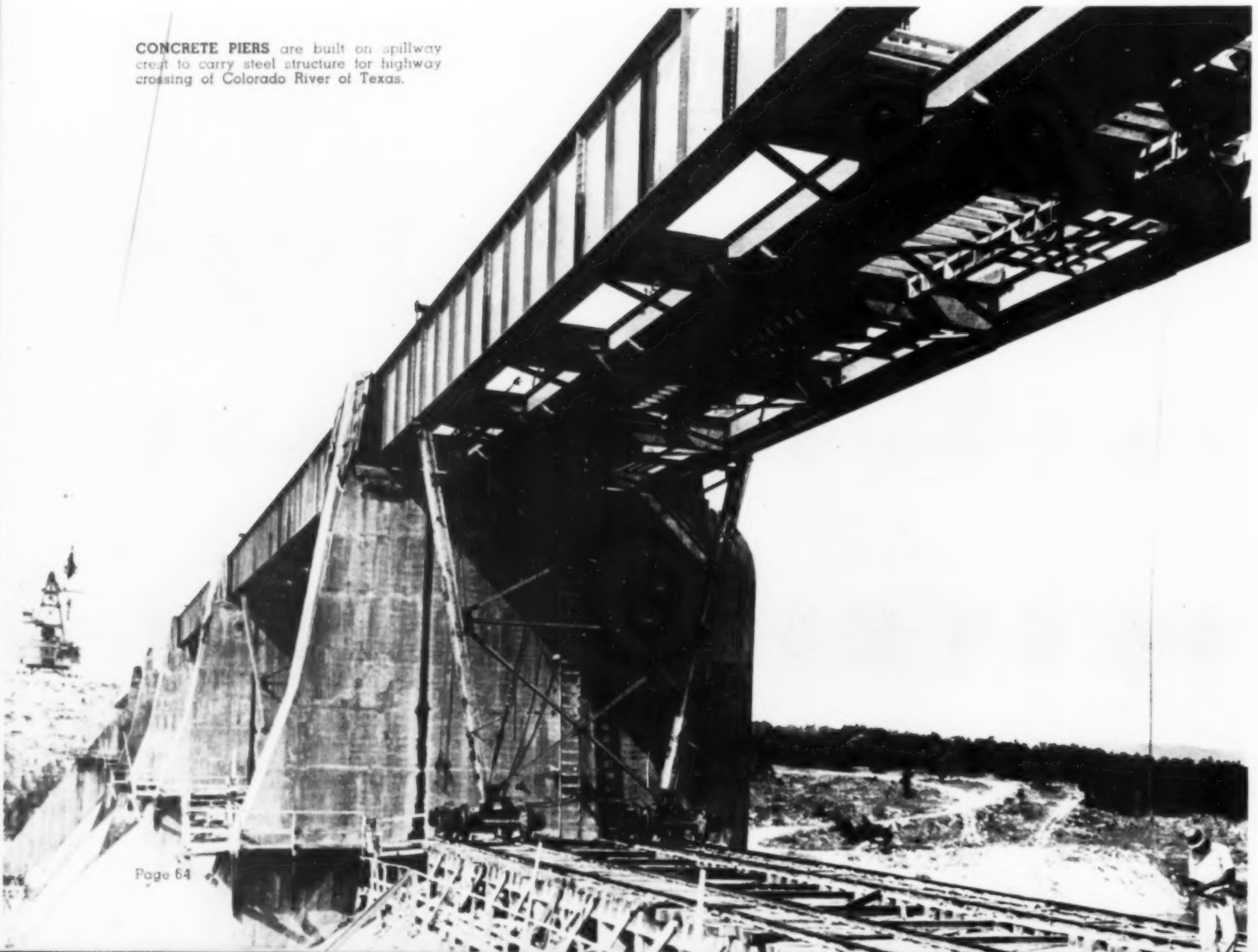
STEEL PLATE GIRDERS are erected to carry 20-ft. roadway of Texas state highway across spillway section of Marshall Ford dam.

STATE HIGHWAY *Crosses Spillway* OF MARSHALL FORD DAM

MOTOR TRAFFIC will soon be able to cross the Colorado River of Texas on a new state highway atop the 750-ft.-long spillway of Marshall Ford dam, being completed 18 mi. northwest of Austin for the U. S. Bureau of Reclamation by Brown & Root, Inc. and McKenzie Construction Co. The 270-ft.-high structure consists of a concrete gravity section 2,423 ft. long, flanked by earth embankments and is the largest of a series of dams for flood control and power development on the Colorado River in Texas. It contains 1,864,000 cu.yd. of concrete.

The spillway bridge, illustrated herewith, is designed as a steel frame structure to carry a roadway 20 ft. wide. Deep plate girder spans are carried by concrete piers extending from the spillway crest. The American Bridge Co. was awarded the contract for the steel on a low bid of \$53,821.

CONCRETE PIERS are built on spillway crest to carry steel structure for highway crossing of Colorado River of Texas.



Present and Accounted For

A PAGE OF PERSONALITIES



GLENNVILLE DAM completed by Aluminum Co. of America in North Carolina, is scene Oct. 13, 1941 of dedication ceremonies attended by these representatives of Tennessee Valley Authority (left to right): **JAMES B. HAYS**, construction engineer on Kentucky Dam; **JAMES P. POPE**, TVA director; and **ROBERT R. MONROE**, assistant chief engineer.



NEW PRESIDENT of American Society of Civil Engineers installed in office during annual meeting Jan. 21-23 in New York City, is **ERNEST B. BLACK**, senior partner of firm of Black & Veatch, consulting engineers, Kansas City, Mo., covering general municipal field and specializing in water supply, sanitation, power and valuation. Former director of society, Mr. Black has served on numerous committees and as chairman of executive committee of Engineering Economics Division.



FEDERAL WORKS AGENCY has new administrator in person of **BRIG. GEN. PHILIP B. FLEMING** (left), appointed by President to succeed John M. Carmody, resigned because of ill health. An officer of Corps of Engineers, U. S. Army, Gen. Fleming during past decade has been on detached duty in capacities including assistant administrator of PWA, coordinator for Resettlement Administration and, for last two years, federal Wage-Hour Administrator. As district engineer he was in charge of Passamaquoddy tidal power project in Maine.

MONTANA HIGHWAY DEPARTMENT is directed by **H. W. HOLMES** (right), appointed state highway engineer to succeed Don A. McKinnon.



NEW MEMBER OF EXECUTIVE COMMITTEE of American Society of Civil Engineers' Construction Division is **ADOLPH J. ACKERMAN**, director of engineering, Dravo Corp., Pittsburgh, Pa. Formerly construction plant engineer for TVA, Mr. Ackerman is co-author, with C. H. Locher, of recently published book "Construction Planning and Plant," based upon series of articles which appeared originally in *Construction Methods*.



DIRECTOR OF PUBLIC WORKS RESERVE for City of New York is **ARTHUR S. TUTTLE**, for 48 years in city's engineering service, most recently as chief engineer of Board of Estimate and Apportionment. Mr. Tuttle is past-president of American Society of Civil Engineers.



NEW ASSISTANT CHIEF OF STAFF, heading War Department's G-4 Division (Supply) is **BRIG. GEN. BREHON B. SOMERVELL**, formerly assistant Quartermaster General in charge of construction. As an officer in Corps of Engineers, Gen. Somervell served in World War, directed construction on Florida Ship Canal and on detached service acted as Works Progress Administrator for City of New York.



FOUR MAIN BUILDINGS, each 1,100x300 ft., in addition to 175 other smaller structures, are located on 2,080-acre site of \$40,000,000 Dgnver Ordnance Plant.

Structures, Large and Small Built on 2,080-Acre Site for



GRADING AND EARTH MOVING on large scale with Caterpillar tractor-hauled scrapers were required to prepare site for plant buildings.



LT. COL. CARL H. JABELONSKY, constructing quartermaster, directed building of huge works for making of small arms and ammunition.

COMPLETED AND FORMALLY PLACED IN OPERATION Oct. 25, 1941, about 5 months ahead of the date originally scheduled, the War Department's new Denver Ordnance Plant in Colorado, a \$40,000,000 project on a 2,080-acre site, involving 178 buildings of various types, including mixing and storage magazines, is now producing .30 and .50 caliber small arms ammunition under the management of the Remington Arms Co., of Bridgeport, Conn., operating on a cost-plus-fixed-fee basis. Under U.S. Army supervision, represented by the Ordnance Department and the Construction Division of the Quartermaster Corps, the huge plant, on which work was started Dec. 26, 1940, was built by Broderick & Gordon, general contractors, of Denver, with the firm of Smith, Hinchman & Gryllis, of Detroit, Mich., acting as architects and engineers. A total of 6,300 men were employed in constructing the plant, which will require a force of about 9,000 persons for its operation.

In addition to 174 smaller structures, including various types of ammunition and TNT storage magazines, and mixing building, the plant comprises four main buildings, each 1,100x300 ft. in plan. In addition to these buildings it was necessary to construct within the plant area 9 mi. of railroad track, 12 mi. of roads, a large steam power plant, a water pumping station of 1,400 g.p.m. capacity and



TRENCH EXCAVATION to depths of 20 ft. for steam pipe lines is done with 3/4-yd. Lorain dragline equipped with Page bucket.

FROM BORROW AREAS earth is loaded by Koehring dragline into one of fleet of 10 Dumpsters which deliver it to form protective embankments over roofs and sides of primer mix and TNT storage buildings.



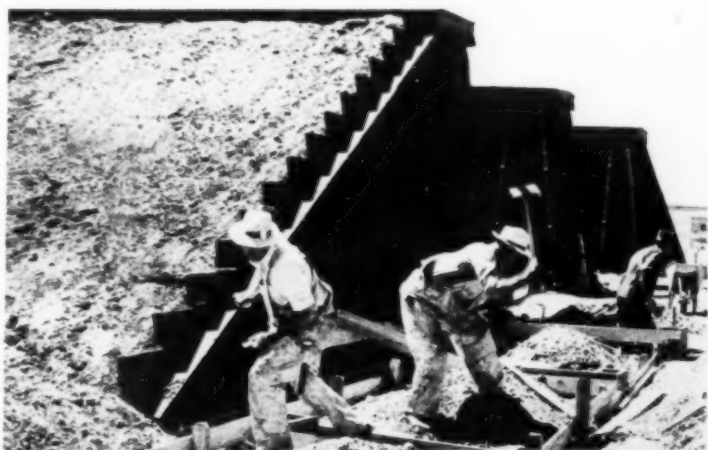
or

Denver Ordnance Plant

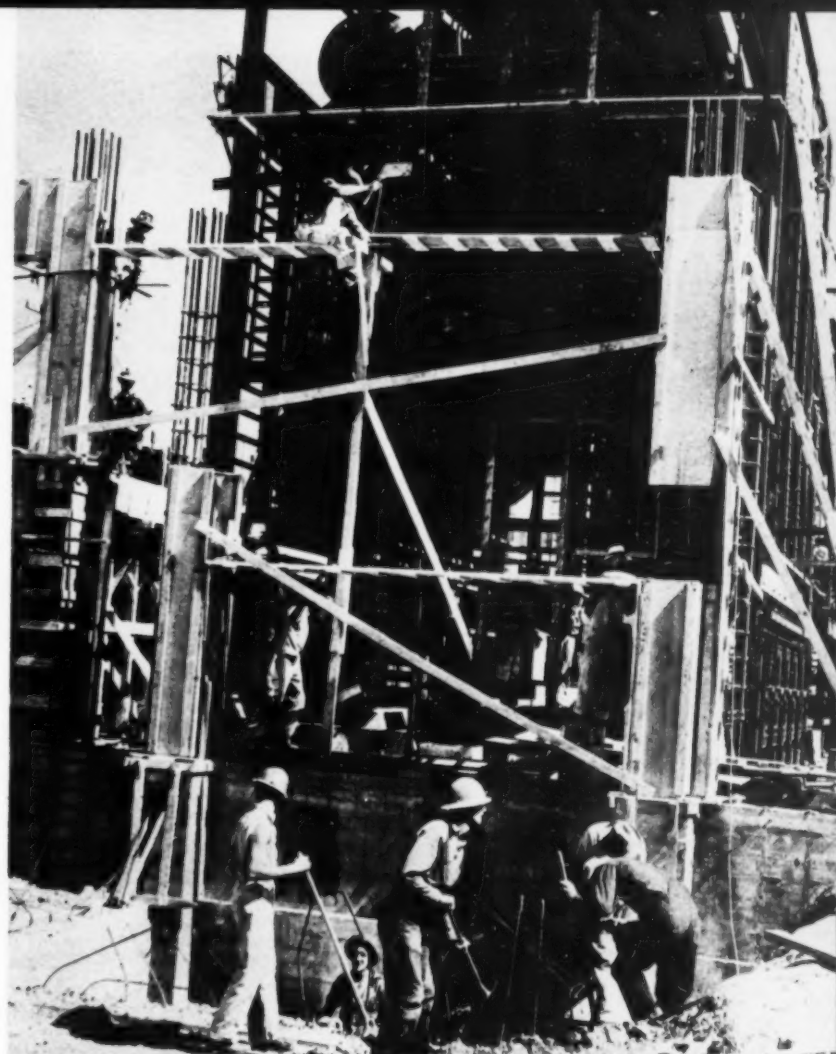
Photos by Thos. J. Harbre



LT. COL. DUNCAN G. MCGREGOR is Army officer in command of Denver Ordnance Plant.



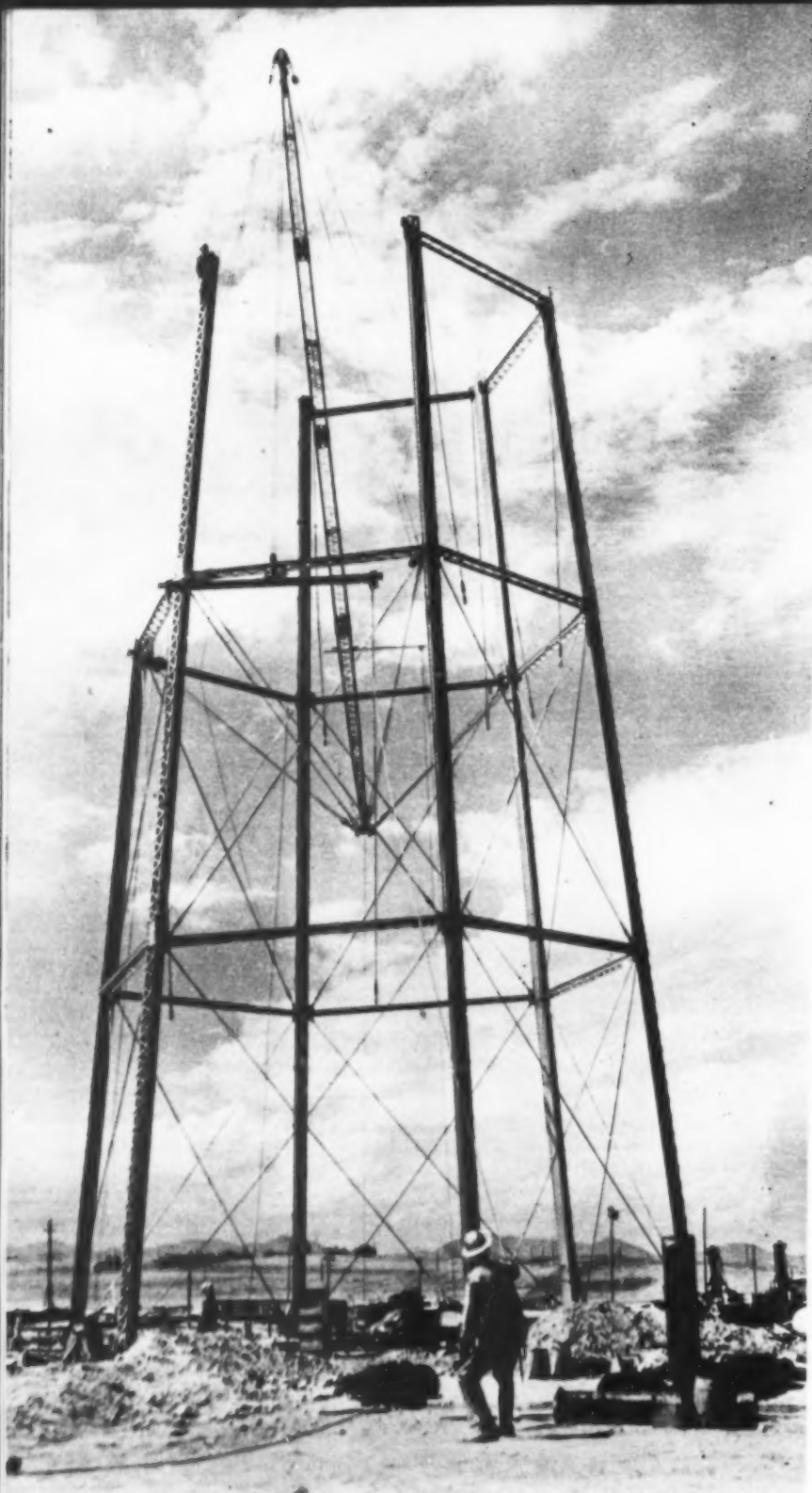
NUMEROUS SMALL, SEPARATED STRUCTURES are built for mixing and storing powder for ammunition. TNT storage magazine (**above**) is built of concrete and (**below**) are units of primary mixing building. Note protective earth blankets covering structures.



BIG BOILER HOUSE and power plant is important structure in group of plant buildings.

STEEL SASH (**below**) in prefabricated units to carry glass windows is hoisted into place to form upper portion of wall above lower brick portion of wall of one of main buildings.





STRUCTURAL STEEL TOWER to carry elevated tank 152 ft. above ground, is erected by Chicago Bridge & Iron Co.

COVERED WALKS (below) connect many individual buildings of plant. Note earth cover over primer dry house units.



MAJOR SETH WIARD served as executive officer under Col. McGregor.

a 200,000-gal. steel storage tank. Other incidentals included 60,000 ft. of electric wiring; 8,332 ft. of gas piping; 58,000 lin. ft. of sewer pipe; and 72,891 lin. ft. of water pipe lines. Pedestrian traffic among the many individual buildings, dispersed over the plant area to minimize the accident hazard, is served by covered walks, built of wood and roofed with galvanized metal sheets bolted to timber framework. Concrete walks supplement the covered passageways.

The main buildings are steel-frame structures, inclosed for the lower portion of their height by brick walls backed up with concrete block, surmounted by prefabricated units of steel sash, providing a considerable glass window area for natural illumination of the interiors. The roofs of the main buildings are carried by steel decks.

An unusual detail of the primer mix building, as shown in one of the illustrations, is a canopy of wire netting carried by pipe framework above the roof. This wire canopy, which is thoroughly grounded, serves the dual purpose of protection against lightning and of trapping flying fragments in case of explosion.

The project, while primarily a building operation, involved earth-moving and grading on a considerable scale. Building sites were graded with tractor-hauled carryall scrapers. Many of the plant structures are served by an elaborate system of insulated steam piping which required trenches, excavated by dragline, up to 20 ft. in depth. Then,

(Continued on page 84)





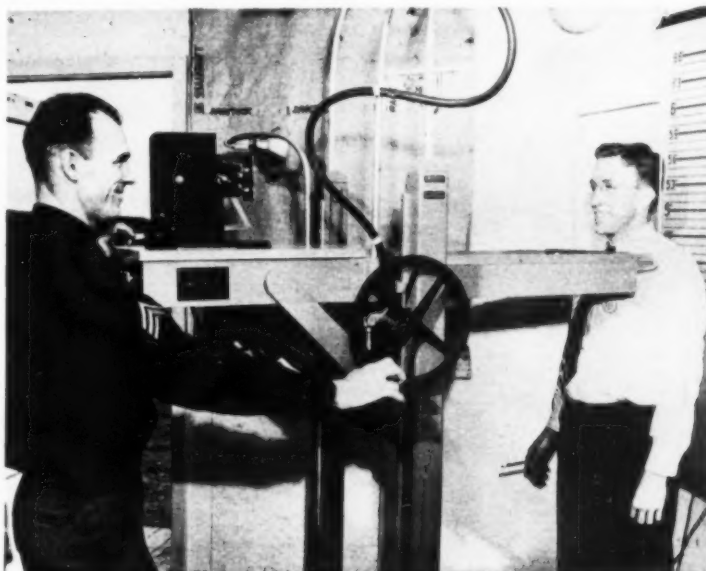
E. E. SWENSSON is in charge of plant production for Remington Arms Co.



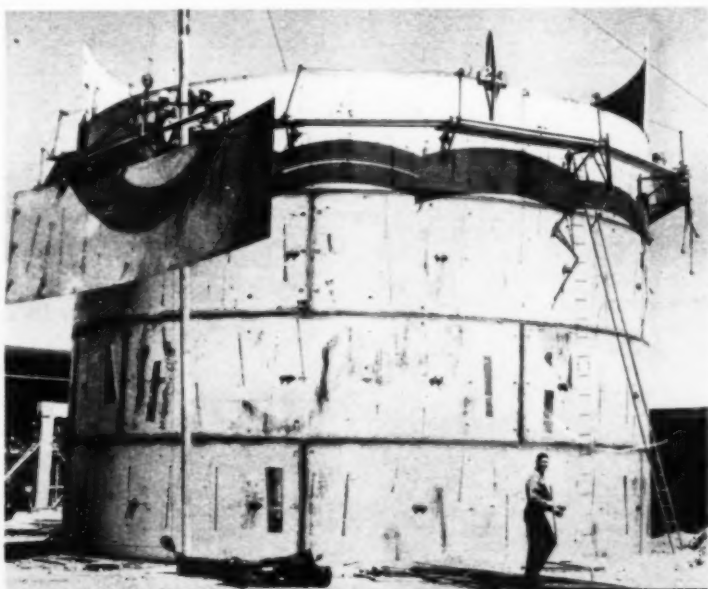
WALL DESIGN calls for concrete block backup with exterior of face brick. Rubber-tired wheelbarrows carry material to masons.



PROTECTION AGAINST LIGHTNING at primer mix building is afforded by canopy of wire fencing, which also serves to trap flying fragments in case of explosion.



EVERY APPLICANT FOR JOB at Denver Ordnance Plant is photographed and finger-printed before being assigned to work.



STEEL WATER STORAGE PLANT of 200,000-gal. capacity is erected to serve boiler house.

PANELS OF PRESSED STEEL (below) form roof deck on main buildings.



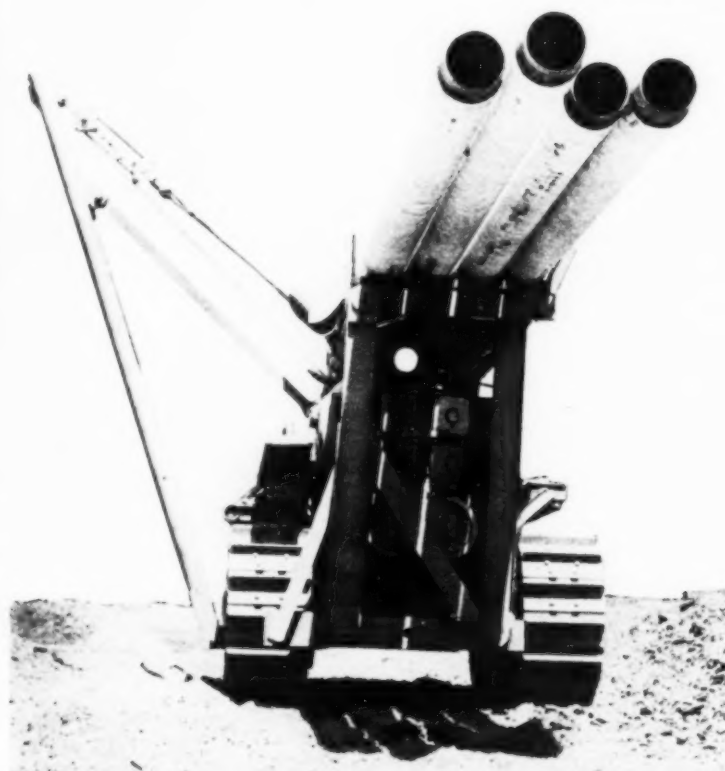
Tractor Rigged TO CARRY OIL PIPE



GRADES AS STEEP AS 50 PER CENT are negotiated by pipe-carrying tractor on new Shell oil pipe line in California. Clamps hold pipe from slipping on slopes.

A NEW TYPE OF PIPE-CARRYING EQUIPMENT has been used by the Macco Construction Co. on the rugged stretch of the new Shell Oil Co. pipe line which extends through the Santa Monica mountains near Los Angeles, Calif. On this job the pioneer line was cleared by tractors operating up and down grades which run as high as 50 per cent, and cross numerous canyons 1,000 ft. deep. Utilizing a tractor and power unit, the contractors rigged a raising and lowering deck, which, when loaded, carries 4 or more 40-ft. lengths of pipe elevated over the tractor. The special rig is equipped so that by being raised or lowered, it can be loaded or unloaded at ground level or on raised aprons, as illustrated in an accompanying photograph.

Pat Dowling Pictures



FOUR 40-FT. LENGTHS OF PIPE are carried by elevated platform on tractor, which is also equipped with side boom for pipe-laying work.

PIPE-CARRYING PLATFORM may be raised or lowered to permit loading or unloading of pipe at various levels, from ground up.



CONSTRUCTION EQUIPMENT NEWS

Review of Construction Machinery and Materials for JANUARY, 1942

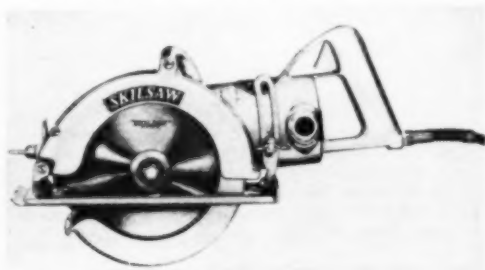
MOBILE METAL WATER TANK. for use on defense projects and other construction jobs, consists of 5-gal. capacity water container, to which are attached dispenser for cups and receptacle for waste. Besides eliminating health hazards common to workmen,



users of bucket and dipper in field, tank has following advantages: (1) Light in weight—complete 7 lb.; (2) easily carried on back; adjustable harness distributes weight evenly; eliminates fatigue; (3) large open mouth permits quick filling—easy and thorough cleaning; (4) equipped with all-metal cup dispenser lent by manufacturer. — **Universal Paper Products Co., 823 S. Wabash Ave., Chicago.**

★ ★ ★

8 1/4-IN. SAW is said to be fast cutting tool for use in framing of houses, schools, churches, factories and similar structures. Recommended for remodeling work, for maintenance sawing, for speedy cutting of wood, steel, lead, copper, aluminum and composi-



tion board. May be used with abrasive disks to cut and score stones, tile and concrete. Cuts to depth of 2 3/8 in. in wood. Bevel-cuts lumber up to 2 1/8 in. thick at 45 deg. Cuts copper and aluminum up to 1/2 in. thick; lead sheets up to 1 in. thick. Blade has free speed of 3,000 r.p.m. and is protected by automatic telescoping guard that rotates on ball bearings. Length, 18 in. Weight, 18 1/2 lb.—**Skilsaw, Inc., 5033-43 Elston Ave., Chicago, Ill.**

★ ★ ★

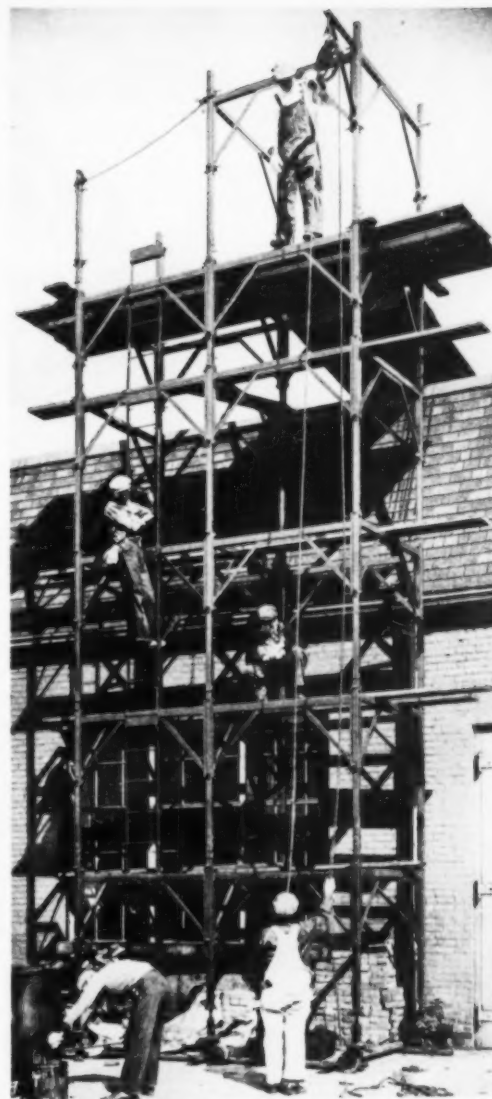
TRIPLE-BODY DUMP UNITS recently acquired by Southwestern Portland Cement Co., of Victorville, Calif., consists of three 8-cu.yd. side-dump bodies 10-ton capacity, 7-ft. inside width, 45 in. high and 10 ft. 6 in. long, mounted on semi-trailers and equipped with 30 1/2-in. telescopic hoists. Powered by Mack 6-wheel, 4-wheel drive tractor. Hoists may be oper-



ated independently or two at a time. One pump for operation of all three hoists is controlled by driver from cab. Dumping valve for each hoist at level with trailer permits handy dumping operation by quarry man at siding. Dumping time per body, 30 sec. Units are interlocked to carry minimum of 30 tons per trip and to operate from company's quarry to its nearest rail siding. Railroad car scoops have same capacity as trailer dump bodies, so on each 18-mi. trip to siding three scoops are filled. — **The Heil Co., Milwaukee, Wis.**

★ ★ ★

SAFETY STEEL SCAFFOLDING built specially for building and other industries that require strong scaffold capable of carrying heavy loading is said to have withstood weights of 700 lb. per square foot without failure and to have been awarded seal of approval for safety by Underwriters Laboratories, Inc. Scaffolding is said to assemble to any height either as single tower or gallery and can be mounted on casters for portability. May be built to bridge over doorway or with openings for trucks to pass through. Assembles to 5-ft. lifts but any brace can be removed from any level of structure to give free and unobstructed working space from any side. Said to be ideally suited for use as material lift because of its great strength. May be assembled or dismantled quickly with inexperienced help. Em-



ploy few strong, lightweight parts, thereby minimizing initial investment, storage and handling. — **Mechanical Handling Systems, Inc., 4600 Nancy Ave., Detroit, Mich.**

★ ★ ★

ASPHALT-MASTIC BOARD, for use in replacing fiber boards and sheet metal if shortages are encountered, is composed of high melting point asphalt and lime mineral aggregate, sealed between dry non-bleeding liners to provide waterproof, rigid non-warping board. Both acid- and alkali-resistant, it may be formed into various shapes, or corrugated. Available in thicknesses 1/16 to 1/8 in., in widths up to 50 in. and in any lengths desired. It is black, but will readily take surfacing finish. Besides its use as roofing and siding material, board may also be used for duct work in warm air heating, air conditioning and industrial air blower systems. Also available is reinforced sheet made with center core of expanded metal laminated between sheets of asphalt mastic board. This product combines properties of regular mastic board, adding tensile strength of metal core. — **Keystone Asphalt Products Co., 43 E. Ohio St., Chicago, Ill.**

★ ★ ★

SELF-ALIGNING IDLER is said automatically to correct misalignment of either carrying or return runs of non-reversing conveyor belts supported on flat-roll idlers. Has centrally pivoted cross-member, which besides being equipped with flat idler roll for supporting belt, has vertically-mounted actuating roll at each end for lightly contacting edge of belt when lateral misalignment exceeds predetermined amount. Slight pressure of belt edge against actuating roll serves to swivel idler unit on its pivot sufficiently to guide belt automatically back to proper alignment, said to eliminate possibility of injury to belt edge. When used on return runs, one idler should be placed close to tail or takeup shaft so that belt will be guided centrally on pulley and one at every ten or fifteen idler spaces. On carrying run, one idler should be placed just beyond loading chute and

this Husky **DUFF-NORTON JACK**



**IS BUILT FOR
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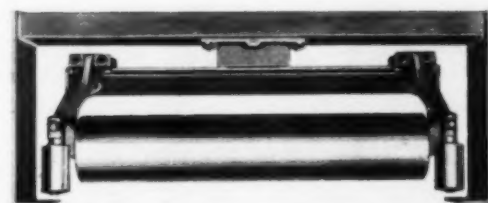
The husky Bridge and Wrecking Jack shown at left is only one of Duff-Norton's complete line of jacks, known to contractors everywhere for their easy operation, efficiency, balance and dependability.

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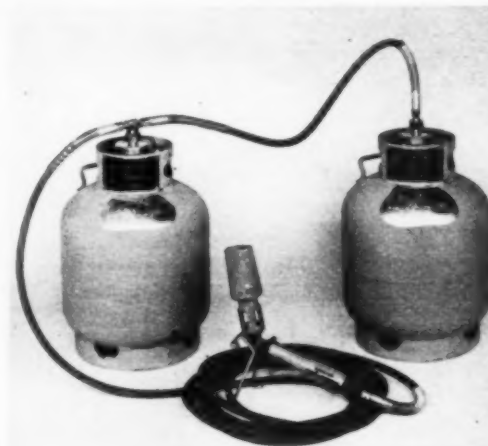
one at every ten or fifteen spaces thereafter. For flat-roll conveyors that must operate in either direction, self-aligning idlers of special design are available.—Link-Belt Co., Indianapolis, Ind.

★ ★ ★

WIRE ROPE. 6x9 filler wire right lay with independent wire rope center and an identifying galvanized core strand, labeled "Tournarope," is offered for use with cable-operated, tractor-drawn equipment. Made of 199 fine steel wires, each wire bathed in oil as it goes into strand die. May be had in six sizes: $\frac{3}{8}$, $\frac{1}{2}$, $\frac{9}{16}$, $\frac{5}{8}$, $\frac{3}{4}$ and $\frac{7}{8}$ in.—R. G. LeTourneau, Inc., Peoria, Ill.

★ ★ ★

HEAVY-DUTY TORCH with flame length ranging from 6 to 24 in. is operated on two or more No. 18 cylinders connected with tandem connector. Number of cylinders required to operate torch at full blast is determined by number of hours of continuous operation necessary to do particular job and tem-



perature at which equipment is operated. Uses: preheating; annealing; heating for coppersmiths; sweating copper pipe fittings 6 in. in diameter and larger; crisping paint on stone or brick before sand-blasting; thawing frozen pipes; removing rims from generators and other special maintenance and construction work.—Insto-Gas Corp., 1900 E. Jefferson Ave., Detroit, Mich.

★ ★ ★

ALL TYPES OF PLASTIC BASES are summarized by new chart printed on buff paper and suitable for mounting on wall, for placing under glass top of desk or for folding to fit standard file for ready reference. Wide range of plaster bases covered by this chart carries through from wood lath to Trusstee, hollow metal lath partitions and includes various types of resilient soundproof systems as well as Bridjoint system and various masonry plaster bases. Summary provides data on fire resistance, average sound transmission loss, recommended plaster grounds, normal partition thickness, approximate weight of wall, materials recommended in addition to lath, quantity of lath required as well as quantity of other plastering materials.—United States Gypsum Co., 300 W. Adams St., Chicago, Ill.

CORRECTION

IN THE OCTOBER ISSUE of Construction Methods the anti-sabotage floodlight manufactured by the Revere Electric Manufacturing Co. of Chicago was described as having a Fresnel lens that produces a beam 18 deg. horizontally. The figure should have been 189 deg.



Model 120 on drainage trenching (at the moment) at Ravenna (Ohio) Ordnance Plant—spoils being discharged into another filling trench. Hunkins & Conkey, Cleveland, Contractors.



Its simplified control and ease of operation is the envy of the "tank corps"—Model 410 makes sewer trench at fast expanding Fort Knox, Ky. Digs forward or backward for undercutting drives, etc. Works in any weather or temperature that the operator can take.

Laying the Groundwork for Defense



Flame hardened gears, manganese steel bucket chain links and pins, chrome-nickel steel dual-driven excavator drive shaft are typical of the construction features that will see this "260" through the next couple of World Wars. It's making trench 5' wide by 15' deep on California defense housing sewer main extension.

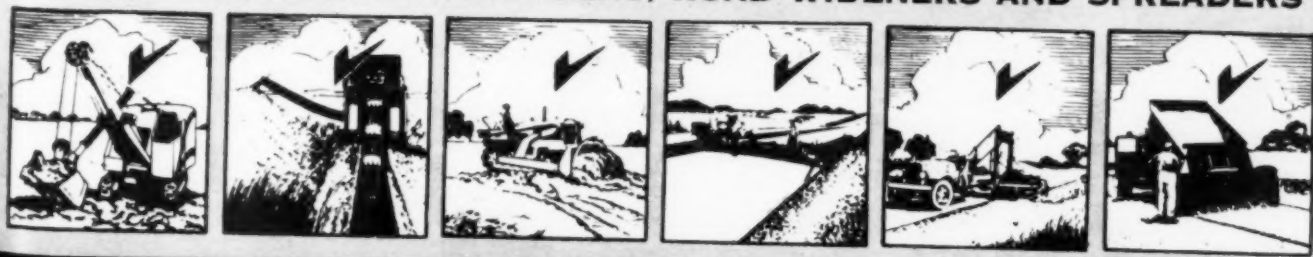
Ahead of the regiments, the airports, the naval bases, the ordnance plants, had to come—and still have to come—trench for foundation footings, drainage, sewage, water and in some cases gas and electricity. Trench dug so that those championing democracy's cause can train and work under democracy's high standards.

Buckeye Trenchers have shouldered the burden of laying this groundwork for defense and the big, modern Buckeye plant is working at top speed turning out new, fast trenchers so contractors can meet the "deadlines" set by Uncle Sam.

**BUCKEYE TRACTION
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Built by Buckeye

CONVERTIBLE SHOVELS, TRENCHERS AND BACKFILLERS, TRACTOR EQUIPMENT, R-B FINEGRADERS, ROAD WIDENERS AND SPREADERS



"LEADER"— CHROME CLAD STEEL TAPES FOR *busy* CONTRACTORS



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MARKINGS
THAT ARE DURABLE**

Tired of trying to use a hard-to-read, old fashioned steel tape? Then now's the time to get a new Lufkin "Leader"—the tape with the Chrome Clad line that contractors everywhere are praising. Jet black markings show up prominently against a satin-chrome surface that won't rust, crack, chip or peel. The "Leader" will be your most useful tool. Order it from your dealer today. Write for free Catalog.

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SAGINAW, MICHIGAN • New York City
TAPES • RULES • PRECISION TOOLS

Tunnel Mucking

(Continued from page 62)

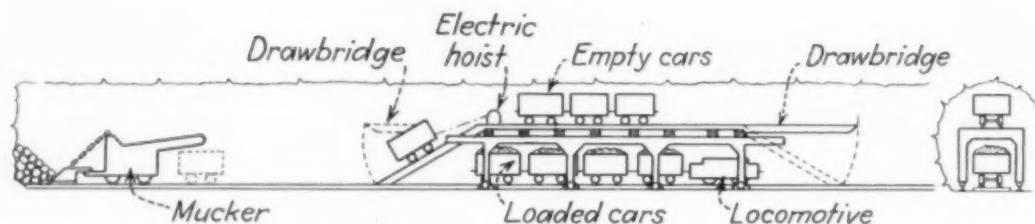


Fig. 24 . . . WITH "GRASSHOPPER" CAR-CHANGER empty cars are stored on upper level; loads are hauled back at main track level; ramps to upper level may be raised to clear passing cars below.

Recently, mechanical methods of cleaning up the invert have been developed on the Delaware Aqueduct. One scheme is to convert a Conway mucker to a slusher by means of a long boom attached to the mucker (Fig. 1). The mucker hoist motor operates a drag scraper which pulls the muck on to the mucker belt. The opposite end of the boom is supported on a skid frame equipped with several hooks for varying the position of the tail sheave. Regular slusher muckers (described later) are also used for cleaning up the bottom. Several contractors on the Delaware job are using bulldozers mounted on electric-drive crawler tractors for scraping the invert muck to within reach of a mechanical loader.

Trapping — Under certain conditions

muck can be very economically trapped by hand into cars. A bottom drift of minimum cross section, about 8x8 ft., is driven, as shown in Fig. 2. Within this drift is erected about 60 ft. of jumbo consisting of square sets about 4 ft. apart, on which is laid longitudinal lagging to form a floor for the breakup. The lags are laid to form a continuous slot about 24 in. wide, covered by short lengths of 2-in. lumber. When the top heading is shot, the muck falls on to the deck and is then loaded directly into cars in the drift below by removing the boards covering the slot. An entire train can be loaded without switching cars. The jumbo is dismantled and reerected as the work progresses.

Although this method is not often em-
(Continued on page 76)

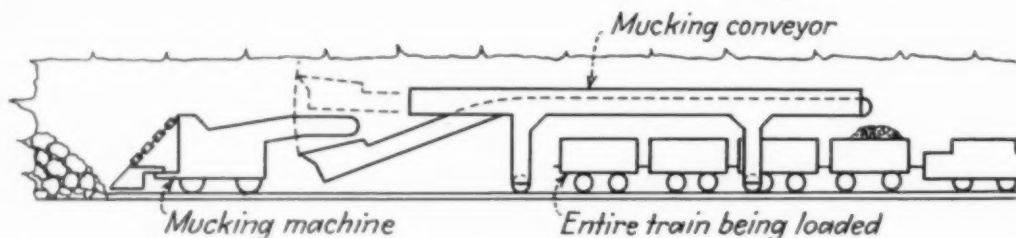


Fig. 25 . . . CONVEYOR of Dixon type loads entire train of cars without switching. Train of empties is shoved under conveyor, then is pulled back slowly to spot each car under discharge end of belt for loading.

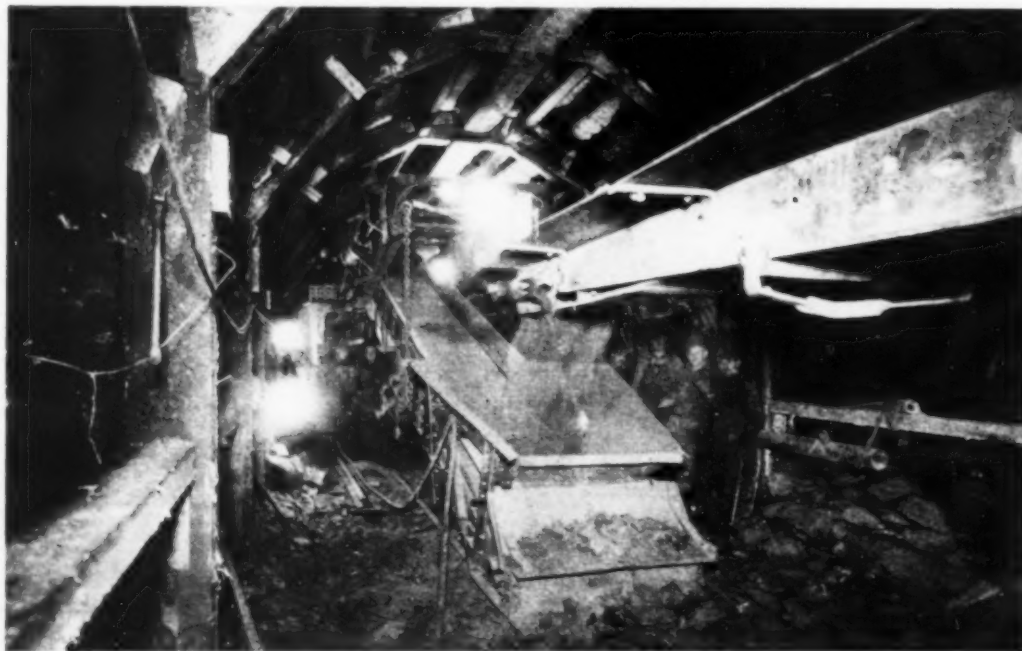
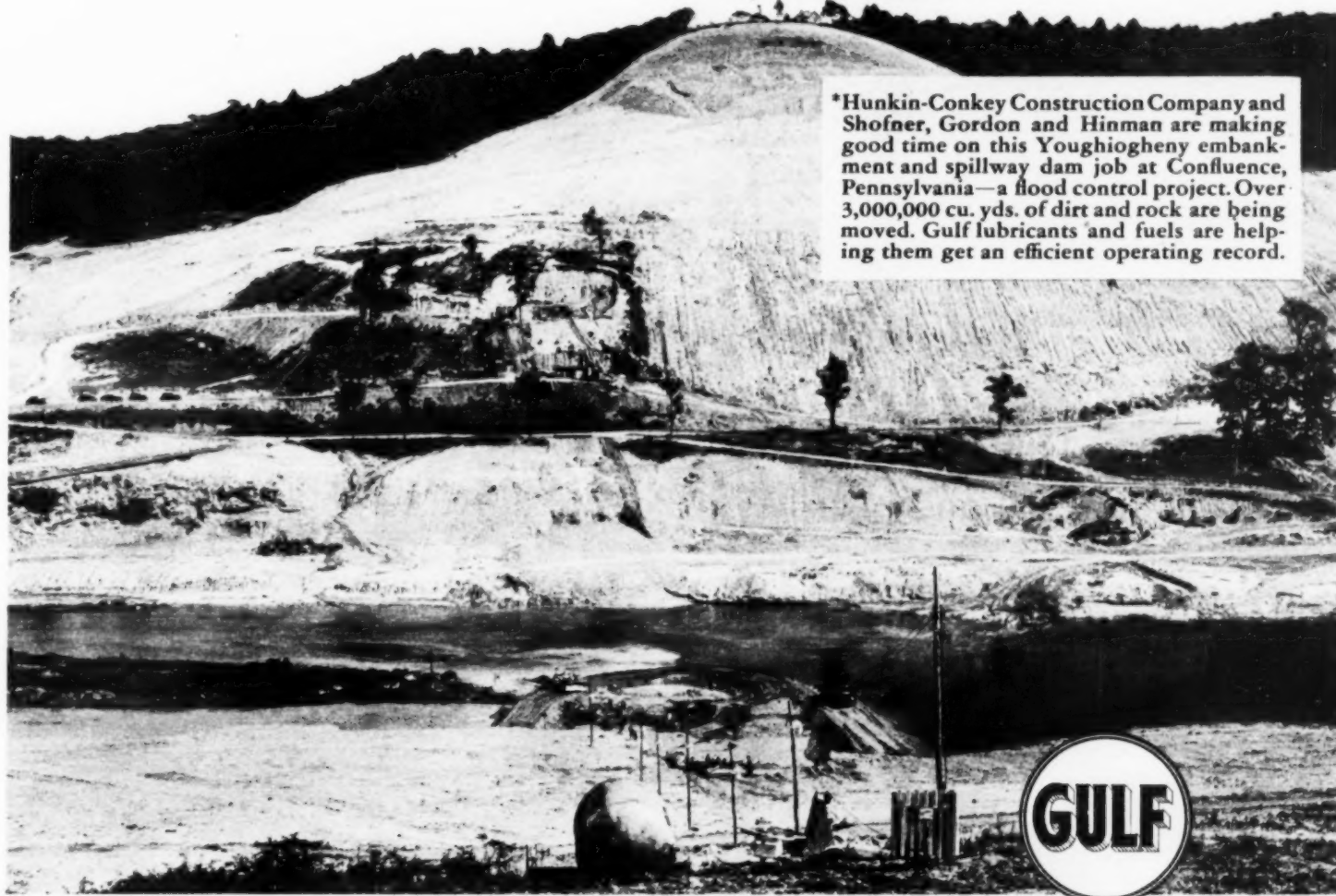


Fig. 26 . . . MUCKING MACHINE at right feeds into boot of Dixon conveyor. Inclined end of Jeffrey conveyor may be raised to permit mucking machine to pass underneath.



**"There's no allowance for needless delays in our contract—
so Gulf Products are a must"**
... say contractors*



*Hunkin-Conkey Construction Company and Shofner, Gordon and Hinman are making good time on this Youghiogheny embankment and spillway dam job at Confluence, Pennsylvania—a flood control project. Over 3,000,000 cu. yds. of dirt and rock are being moved. Gulf lubricants and fuels are helping them get an efficient operating record.



"THERE'S no allowance in the contract covering this job for delays caused by unnecessary mechanical troubles and inefficient operating performance of equipment," says the contractor on this dam project, "so we took no chances with our lubricants and fuels. Right from the start we standardized on Gulf quality products as recommended by a Gulf engineer. This safety measure has helped us operate on a fast work schedule."

Here's the big reason why so many contractors standardize on Gulf products: They have found that Gulf supplies lubricants with the stability and toughness to give full protection under the severe conditions con-

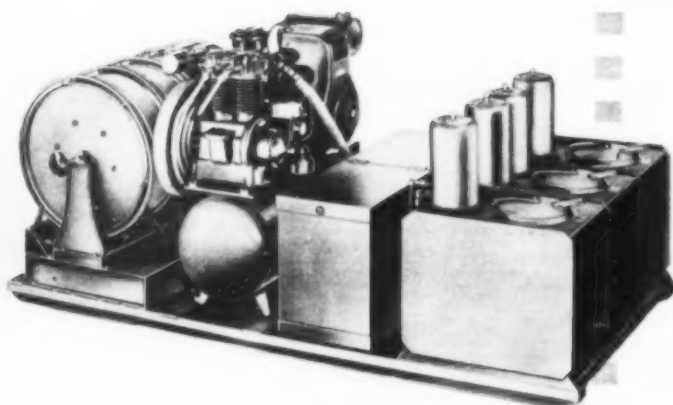
nected with this type of service—and fuels of a uniform quality which give maximum performance. Result: Efficient, trouble-free operation of equipment, with low costs for maintenance.

Make sure your equipment gets the benefits of Gulf quality lubricants and fuels on *your* next job. They are quickly available to you through more than 1200 warehouses in 30 states from Maine to New Mexico.

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★ The Graco CONVOY LUBER ★

... Lubricates Trucks, Tractors and all kinds of construction equipment **ON THE JOB**



★ You can save time, reduce costs, minimize breakdowns and delays by using the Graco Convoy Luber for modern, high pressure, *on-the-job* lubrication. Various models offer power facilities for all types of lubrication service. Completely assembled at the factory and mounted on a rigid steel frame, Graco Convoy Lubers can be loaded on a truck or trailer and put into active operation in a few minutes. Write or wire for details.

FEATURES

Air Powered Lubricant Pumps

Each different lubricant employed is dispensed at proper pressure and in proper volume by a powerful pneumatic pump of scientific design and high quality construction. Pumps are powered by air from built-in, engine-driven air compressor.

Convenient Hose Reels

Each of four or more hose reels, conveniently mounted at the rear of the unit, carry 30 feet of lubricant hose. Each lubricant hose terminates in a control valve and suitable nozzles and adapters. Another reel offers 50 feet of air hose for tire inflation.

Complete Accessory Kit

Each Graco Convoy Luber includes a complete kit of five hand guns, oilers, and other lubrication accessories as well as extra adapters and spare parts for emergency use.

Dispense from Original Containers

Convoy Lubers are offered to dispense from original 100-lb. or 400-lb. containers or from leaded steel lubricant tanks. Tanks have built in exhaust heater for use in cold weather.



GRACO

GRAY COMPANY, INC. MANUFACTURERS OF HIGH QUALITY LUBRICATING EQUIPMENT • Minneapolis, Minn.

(Continued from page 74)

ployed, it has certain advantages. The bottom drift provides good drainage and, after the drift is holed through, good ventilation. Cars can be efficiently loaded with a minimum of shoveling and without switching. This system is sometimes employed in the center-drift method for catching up bad ground ahead of the enlarging crew.

Belt Conveyors

Belt conveyors for loading cars can often be used to good advantage in hand mucking, both in rock and in soft-ground tunnels. They can also be used in connection with machine loading. The authors believe that if the possibilities of belt-conveyor loading were more fully realized by tunnel men, conveyors would be used more. The conveyor may be any length desired; for hand loading any number of shovelers may be used, and the discharge end may extend as far as desired over the string of cars, in fact, over a full train.

The discharge end is carried on a jumbo or framework under which the cars are placed. A good example of the use of conveyor loaders is found on the Olmstead and Alpine-Draper Tunnels on the Provo irrigation project in Utah. A small Eimco mucking machine loads on to an inclined belt, which extends on a traveling framework back over a full train of cars. At the start of the mucking cycle a string of empty cars is shoved under the framework; the belt discharges into the car next to the locomotive, at the rear of the train. As each car is loaded the train is pulled back a car length, thus placing an empty car under the discharge end of the belt.

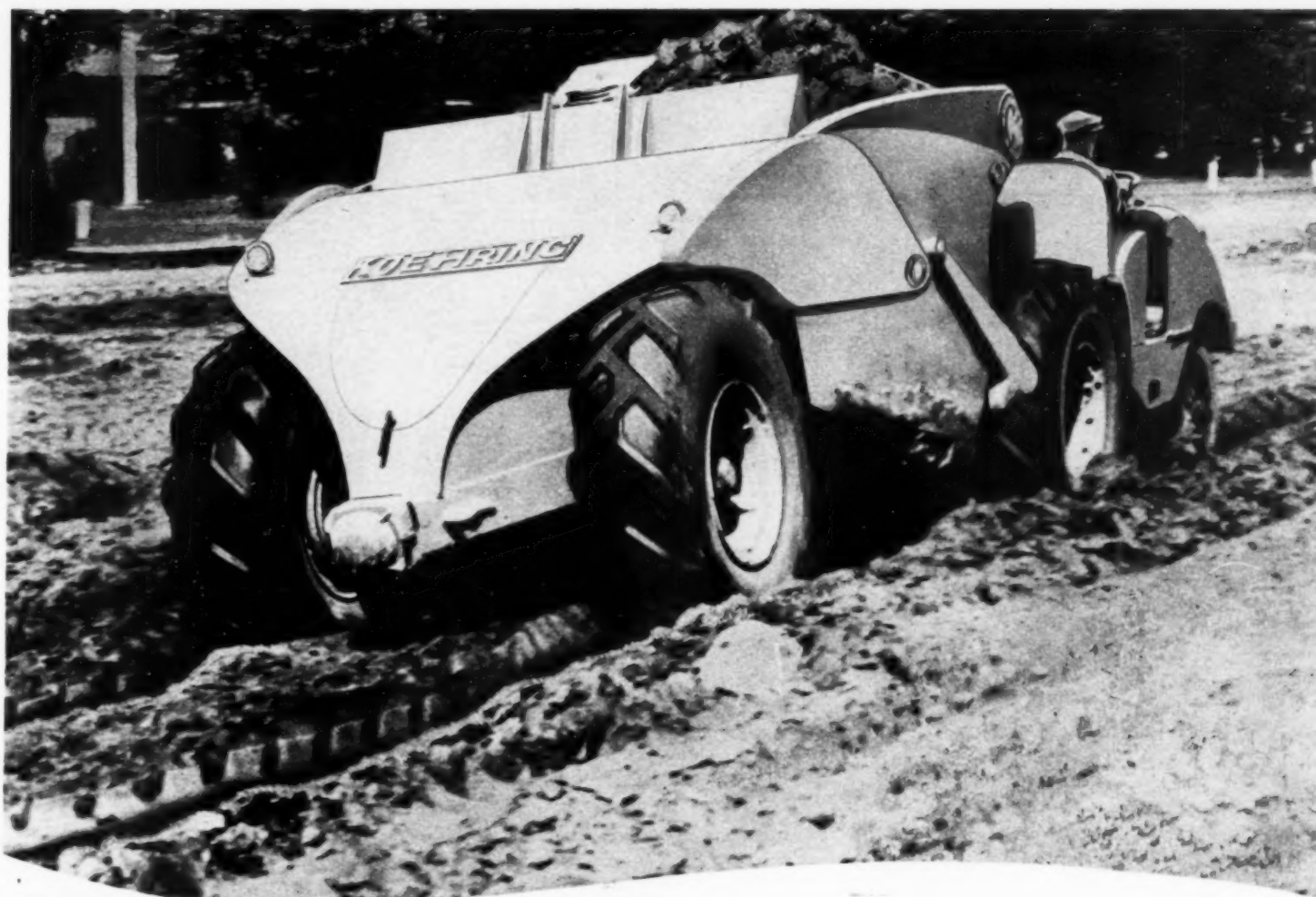
Muck conveyor belts are usually made of plied rubber running on dished rollers, though the belt can be made up of steel plates, as shown in Fig. 3. Skirts or side boards should be placed along both sides of the belt to prevent spilling of the muck. Motors for operating belt may be either electric or air.

Mechanical Loaders

Railroad Type Shovels—The first tunnel shovels were ordinary rail-mounted steam shovels converted to this new use by the simple expedient of connecting a compressed-air line to the boiler. Often these shovels were of standard gage, and the tunnel cars were of narrow gage, making it necessary to lay two tracks. A later type is built to run on 36-in.-gage track. The boom and dipper stick are proportioned to fit the particular tunnel. These machines load on an adjacent track, necessitating double track near the face; but the track on which the shovel stands is used for the delivery of the empties, these cars being transferred to the loading track one at a time by means of the "cherry picker," or boom, mounted at the rear end of the machine. These machines must be moved back at least 150 ft. before shooting, as all the machinery is at the front end exposed to fly rock.

Full Revolving Shovels

Full-revolving shovels running on nar-
(Continued on page 78)



TRAVEL CLEARANCE FOR DEEP RUTS



- High body travel clearance when loaded assures steady hauling over soft and rough haul roads. Reduction of hauling time is increase in loads per hour.

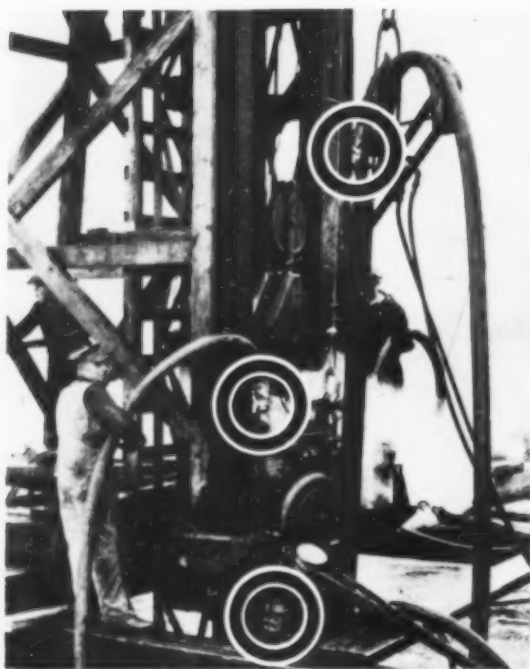
21" Body Travel Clearance Cuts Hauling Time

High loaded body clearance of the Koehring Wheeler permits uninterrupted hauling over deeply rutted haul roads. Twenty-one inches clearance, ample flotation and horsepower per gross ton load, are important Wheeler advantages for continuous high speed hauling over rough and soft haul roads. When traveling time is reduced, you get more loads per hour, more yards per shift. Koehring Wheeler Method of Moving Dirt reduces costs per yard and moves more dirt in a shorter time.



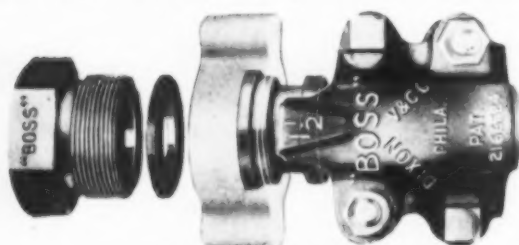
KOEHRING COMPANY • Milwaukee, Wisconsin

HEAVY-DUTY CONSTRUCTION EQUIPMENT



"BOSS" COUPLINGS

for All Heavy-Duty Connections!



"BOSS" FEMALE COUPLING WASHER TYPE, STYLE W-16

"BOSS" Couplings provide safe, dependable, low-cost service on all steam, air and liquid hose lines. Correctly designed and strongly built. "BOSS" Offset Interlocking Clamp anchors entire coupling to hose with powerful grip. Sizes 1/4" to 4", incl. Cadmium plated — rustproof.

"G J-BOSS" FEMALE COUPLING GROUND JOINT, STYLE X-34

Same as above, except washerless construction. Copper insert in spud fits rounded head of steel or malleable iron stem, forming perfect soft-to-hard metal seal that remains leakproof, regardless of wear.

"BOSS" MALE COUPLING STYLE MX-16

Companion coupling to both of above. More convenient and economical than regular I. P. nipples — does not require oversize or enlarged-end hose.

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MAIN OFFICE AND FACTORY: PHILADELPHIA
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(Continued from page 76)

row-gage tracks have the advantage over the railroad type shovel in being able to load to the rear on the same track, thus only requiring single track. In case of double-track operation, they can load cars alternately to the side and to the rear, thus eliminating the delay of cars changing. Fig. 5 shows an air-operated shovel, equipped with a 1-cu.yd. dipper, designed to work within a 17-ft. tunnel.

There are several models of miniature full-revolving shovels, air-operated; the smallest will work within a tunnel of 7x7-ft. cross-section, and is fitted with a 4 1/2-cu.ft. dipper.

Another type of full-revolving shovel is shown in Fig. 6. This machine has the cherry picker mounted on the same truck, so that loading must all be done to the side. This cherry picker is equipped with an electric hoist.

Crawler-mounted shovels with short booms and dipper sticks are frequently used in larger tunnels. A 1 1/4-cu.yd. electric shovel with extremely short tail swing can work in a tunnel whose minimum width is 20 1/2 ft. A special tunnel shovel can load 5-cu.yd. cars in a tunnel of 17-ft. clear width.

Crawler Shovels

The crawler type of shovel, of course, needs no track and can load to either side or to the rear. As the back end of shovel may be protected by timbers, it need not be moved so far before shooting. Their disadvantage is that they are extremely hard on track as they crawl back and forth, and their width makes it difficult to pass the drill carriage. This last objection is particularly noticeable in round-bottom tunnels.

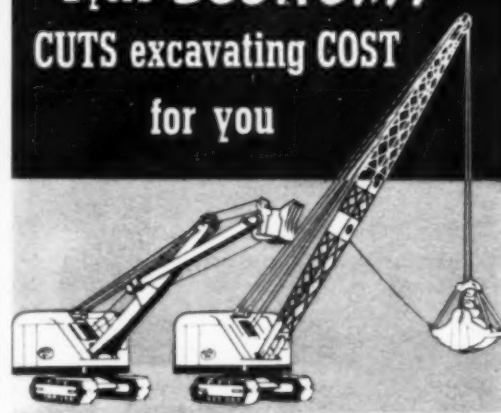
A miniature type of crawler-mounted shovel is shown in Fig. 8. Still another type of electric tunnel shovel has a reach of 14 ft. 7 in. from center pin, yet will work in a 15-ft. tunnel. Crawler shovels, either electric or diesel powered, were used in all the Pennsylvania Turnpike tunnels.

Mine Car Loaders

There are several types of mine car loader designed for mucking in small tunnels or drifts, such as those made by Eimco, Gardner-Denver and Sullivan. These machines will work in tunnels as small as 4x7 ft. They are equipped at the front end with a small dipper which is crowded into the muck pile by moving the whole machine forward. When the dipper is full, the muck is cast back over the top of the loader into a car or on to a belt. Though the dippers are small, the fast operation of the machine turns out remarkable yardages. In fact, the world's record for tunnel driving in rock to date, 1,879 ft. driven in one month (March, 1940) from a single heading in the 10x11-ft. Carlton drainage tunnel in Colorado, was made with this type of loader. The machines are air-operated.

By far the most popular mucker on tunnel jobs, both large and small, is the Conway. Phenomenal records have been made with this machine, such as twenty-four 6-yd. cars, or 144 cu.yd., being regularly

Byers **ECONOMY**
CUTS excavating COST
for you



• They're easy on gas. Easy on cables. Easy to adjust and repairs are down to rock bottom. That's what Byers owners say. That's why Byers' economy cuts excavating cost.

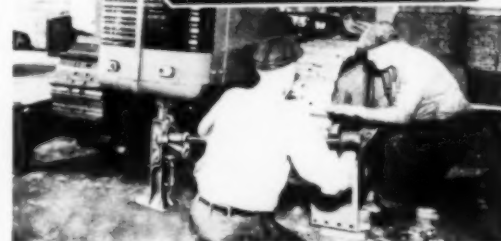
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Simplex Jacks are safer—lift their full rated capacity on cap or toe—no screws or bolts to come loose — unbreakable trunnions and other safety features that earned the Gold Medal Award for Safety. Made in 5, 7 1/2, 10, 15 and 20-ton capacities. Send for 58-page Catalog 41.

It's safer to use Simplex Jacks—lever type for toe and cap lifting, hydraulic for speed, screw jack for economy.

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Simplex Jacks
A better Jack for every job -
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loaded out on the Colorado River Aqueduct, with one 60-hp. machine in 2 hr.

The Conway mucker, Fig. 10, consists of a dipper hinged to the front edge of an apron. This apron is, in turn, hinged to the frame and, when raised, slides the muck lying on it on to a belt conveyor, which discharges into the car. It has only two hoists, one connected to each corner of the dipper. By tightening either drum, the dipper swings either right or left. If both drums are tightened simultaneously, the dipper is raised until its contents slide on to the apron plate. Further raising of the dipper will tilt the apron to slide the muck on to the conveyor belt.

The dipper is filled by advancing the whole machine into the muck pile. When the dipper is filled, it is raised until the muck slides on to the apron; after several dipperfuls the apron is raised to slide the muck on to the belt. The empty car is coupled directly to the machine, Fig. 11, by means of a jack-knife drawbar. After the back end of the car is filled, the jack-knife is tripped and the forward end of the car filled. One type of jack-knife link is shown in Fig. 12. Extremely long cars may need a three-position link to trim the load properly.

This type of machine will efficiently clean up fly rock and dig out the corners of the tunnel. It is extremely hard on track, for it charges back and forth for each dipperful; therefore, the temporary track must be unusually well laid to avoid derailments.

Slushers

Slushers, or scrapers, are another loading device borrowed from the mining industry for use on several tunnels. As shown in Fig. 13, the slusher consists of a car on which is mounted a slide whose angle is about 20 deg. On this car is a two-drum hoist hauling a bottomless scraper back and forth. The muck car is run under the upper end of the slide and the scraper load drops into it. The tail block is anchored to the face in some manner as shown in Fig. 14; the block may be moved from one side to the other or to any position in the heading.

There is no reason why the tail of the slide cannot extend much farther than shown here, so that several cars could be loaded without switching. The city of Chicago built such a scraper with eight bottom-dump pockets over the track, each holding one carload. When an empty train ran under the slide all pockets were dumped simultaneously.

The slusher requires a good deal of hand-work, for the scraper will not work close to the face or walls.

Car Changers

The mechanical mucker has come into tunnel driving only within the last twenty years. Before that time almost all small and medium-sized tunnels were hand-mucked. From 4 to 10 min. were required to hand-load an ordinary car; the 2 or 3 min. taken up in changing cars were considered valuable as a "breather" to the hard-working muckers. Modern mucking

(Continued on page 80)

Insure Against Delays with DIAMOND Roller Chain DRIVES

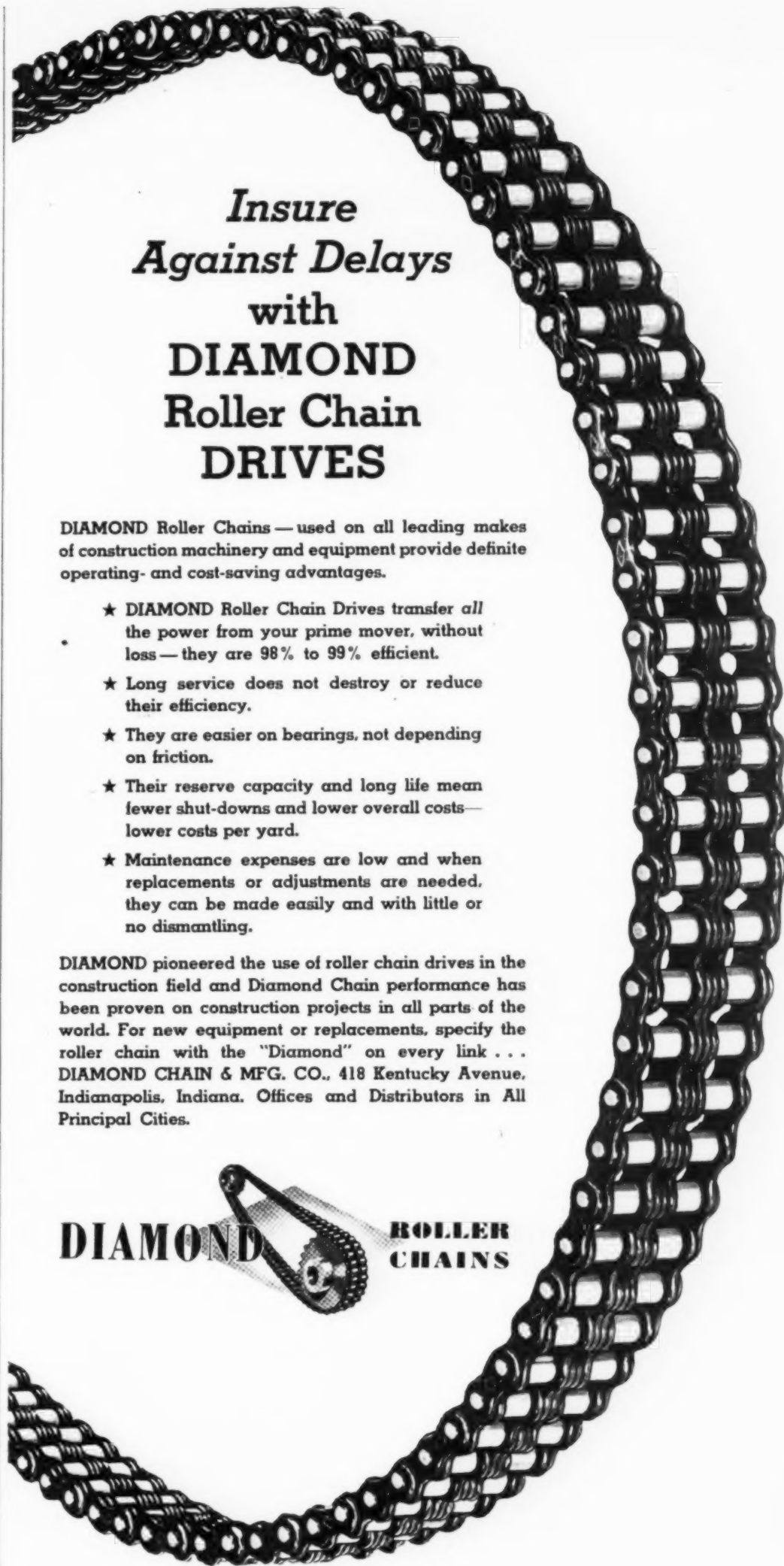
DIAMOND Roller Chains — used on all leading makes of construction machinery and equipment provide definite operating- and cost-saving advantages.

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- ★ Maintenance expenses are low and when replacements or adjustments are needed, they can be made easily and with little or no dismantling.

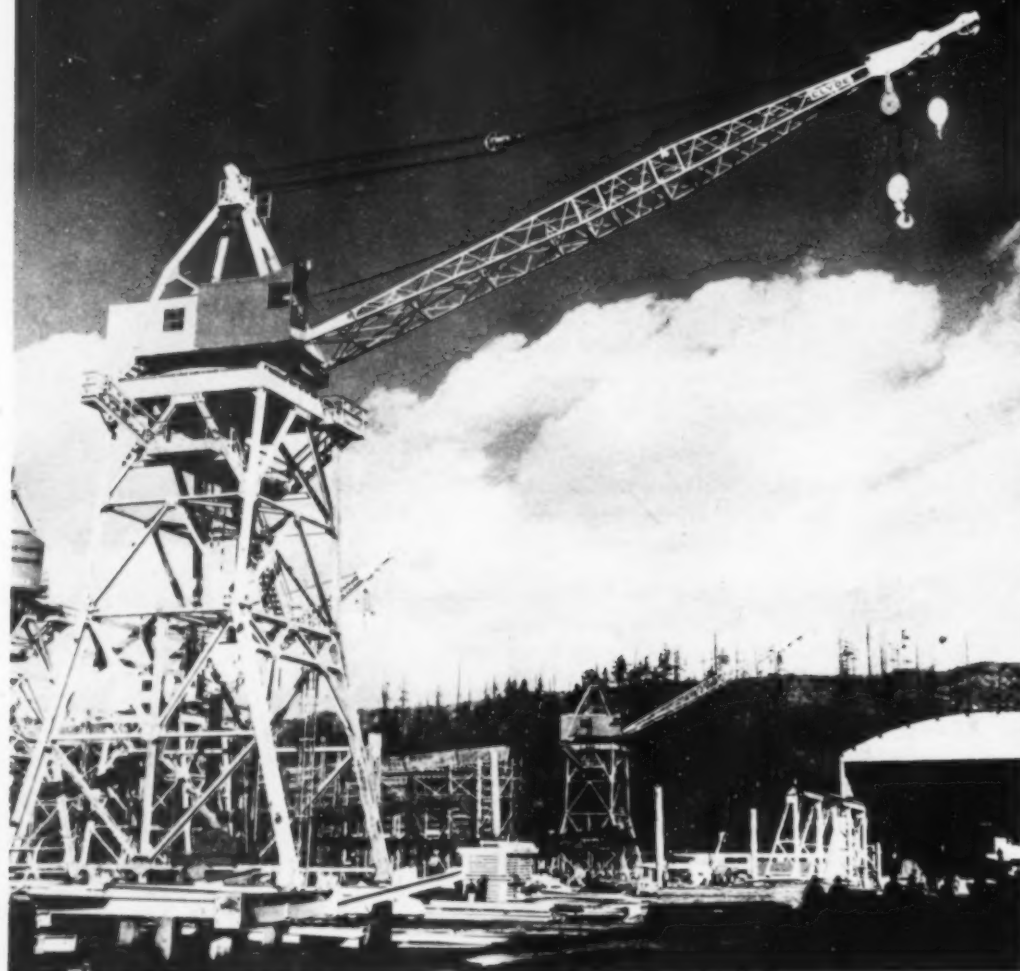
DIAMOND pioneered the use of roller chain drives in the construction field and Diamond Chain performance has been proven on construction projects in all parts of the world. For new equipment or replacements, specify the roller chain with the "Diamond" on every link . . . DIAMOND CHAIN & MFG. CO., 418 Kentucky Avenue, Indianapolis, Indiana. Offices and Distributors in All Principal Cities.

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CLYDE WHIRLEYS



ON THE LARGEST CONSTRUCTION JOB IN HISTORY!

Scientifically engineered Clyde Whirleys keep pace with the fast moving schedule of America's huge building program . . . ships, dams, locks and bridges. Every piece that goes into these long reaching, fast moving, versatile machines has been carefully and accurately designed for its particular duty to assure the utmost in safety and efficiency.

Seven standard sizes with lifting capacities up to 140,000 lbs. at a 35 foot boom radius and 22,000 lbs. at 150 feet. Powered by Diesel, electric, steam, gasoline or Diesel-electric.

CLYDE IRON WORKS, INC.

DULUTH, MINN.

HOISTS • WHIRLEYS • CARPULLERS • DERRICKS • DECK MACHINERY

(Continued from page 79)

machines can load a 5-cu.yd. car in from 1 to 3 min.; any shortening of the car-changing time is directly reflected in the mucker output.

Simple Car Changers

In very small tunnels the empty cars will be lifted off the track while the load is run back. In this system the string of empties is run as close to the face as possible and all except the first one turned off the track and leaned against the tunnel wall. As the cars are loaded, they are pushed back into the tunnel where the locomotive can get them, and the next empty is set back on the track. Cars for this service should be light enough for two men to tip, but sturdy enough to withstand the rough usage they receive.

There is, of course, only single track at the face. The rails are extended by telescoping a rail turned sideways ahead, Fig. 15, until there is room enough to lay a full rail.

When hand mucking is employed, slick sheets are laid on the floor of the tunnel for about 20 ft. from the face. If the single track ends at the edge of the slick sheets, even quite large cars can be run off the rails on to the slick sheets where they can be skidded sideways against the wall until the full car is run back on to the rails.

Passing Track

The passing track was the standard method of switching cars in the heading until the last few years. A side track, Fig. 16, long enough to accommodate a train was laid close up to the face. The locomotive came into the heading pushing the cars. One car was shoved up to the mucker; then the rest of the empties were left on the "empty" track. The locomotive was uncoupled from the train and, when the first car was loaded, coupled on to it and retired to the "loaded" track. An empty car then was pushed up to the shovel. If the cars were of 1- or 2-yd. capacity they could be hand-trammed to the mucker, but with cars of 4- or 5-yd. capacity a mule was employed. When this car was filled, the locomotive again advanced and removed it. The mule then drew the next empty to the face. When the locomotive had collected a train load, it left for the dump, and the next train took its place. An empty was always left at the mucker to become the first car of the next train.

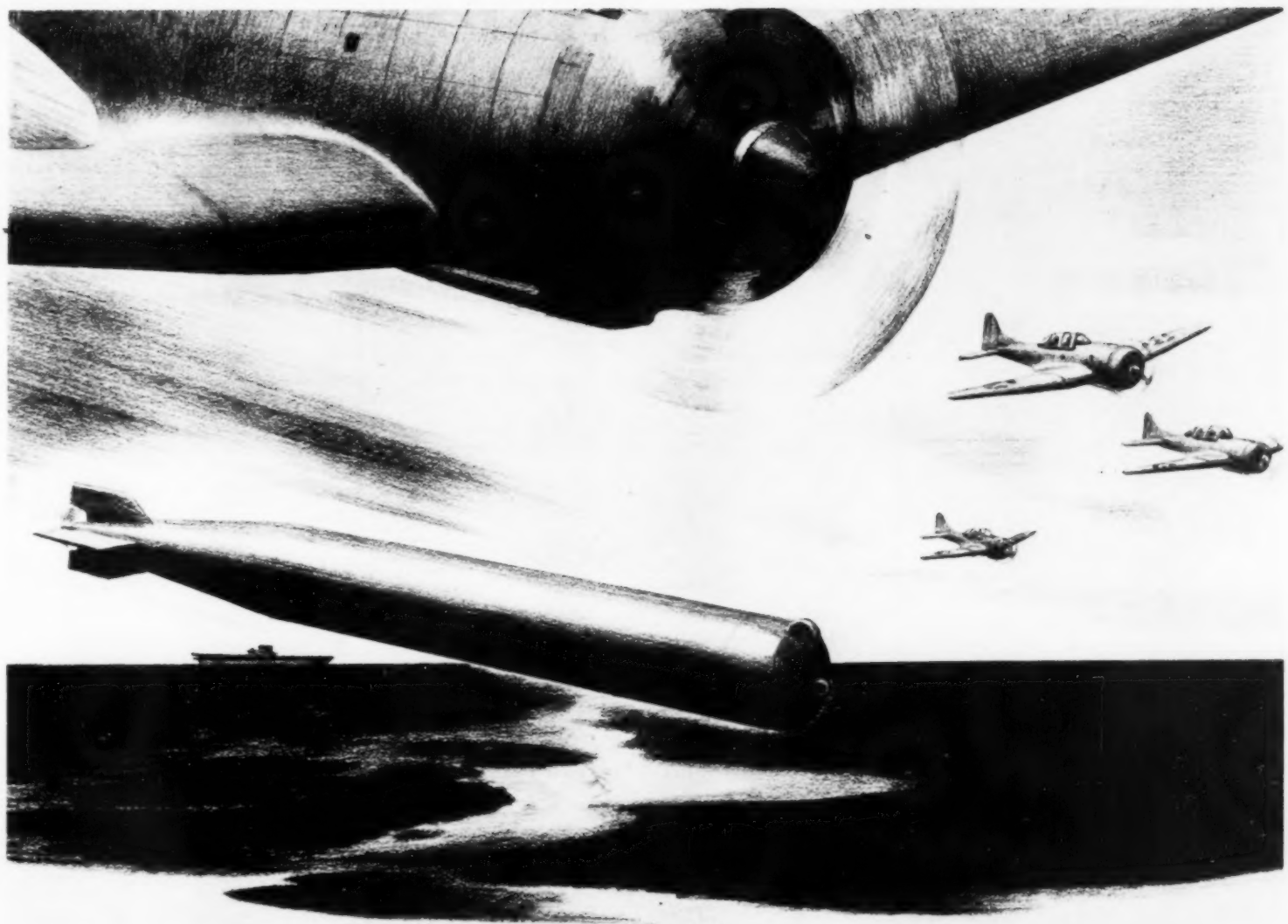
The disadvantage of this system was the difficulty and delay in moving the passing track forward as the heading advanced. This moving of the switch was a time-consuming operation, generally done on Sundays. Meanwhile, as the heading advanced, the switch fell farther and farther behind the point of efficient operation.

California Switch

The California switch, Figs. 17 and 18, was a development from the passing track. This switch is made of two jumper-type Y-switches, with rails, all welded on to steel ties of 3/4x4-in. bars. The clear length of the siding should be about 60 ft.—enough to pass an entire train.

Modern practice mounts an air hoist on

(Continued on page 82)



5,500 Aerial Torpedoes for Uncle Sam from Steel Conserved by Preformed Wire Rope

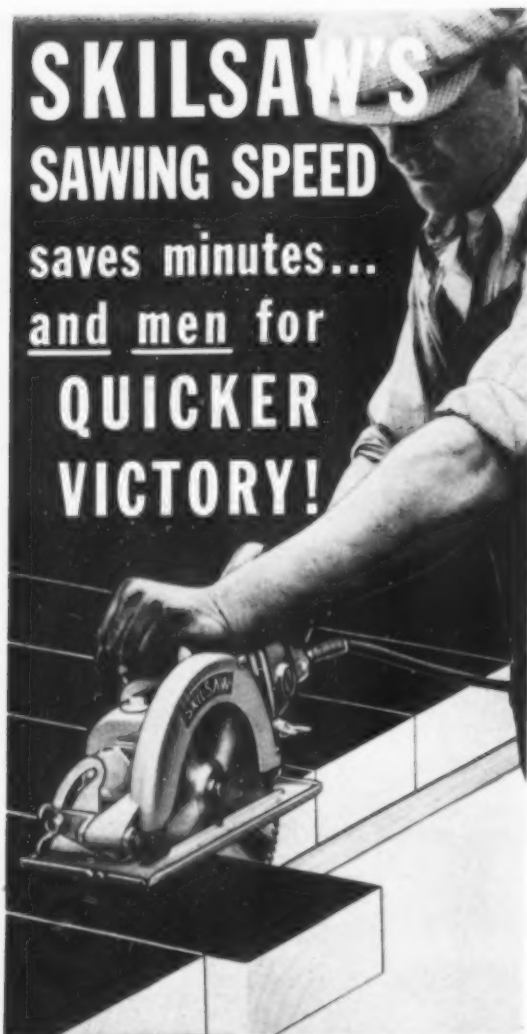
- ★ Preformed wire rope can help you meet emergency production demands because it wears longer than ordinary or non-preformed cable. Lasting longer, it reduces machine shutdowns for replacement. And that steadies production—makes man and machine hours more productive. In addition, preformed wire rope is easier, faster, safer to handle. It saves both time and money.
- ★ Now there is another reason for using preformed wire rope. Through its ability to last longer, *it conserves steel for other National Defense requirements.* Indeed, the steel conserved by the use of long-wearing preformed wire rope, in 1941 alone, would be enough to fabricate more than 5,500 aerial torpedoes.
- ★ Preformed wire rope is an essential to American industry—a necessity for the Nation.

PREFORMED WIRE ROPE

Ask Your Own Wire Rope Manufacturer or Supplier



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SKILSAW DRILLS



For all drilling, boring and reaming in construction

Powered for deep wood boring in timbers... in roof truss construction, bridge building and erection of dams, superstructures and a hundred other jobs. Stronger, more durable, more powerful throughout.

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SKILSAW PORTABLE ELECTRIC TOOLS

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You need fast-cutting SKILSAW for all sawing because Time, itself, is a weapon now... and SKILSAW saves the minutes on every operation that mean priceless hours saved on every job. SKILSAW is faster because it is more powerful, lighter, easier-to-use... and its speed helps you complete projects ahead of schedule in spite of the present shortage of skilled hands.

Test SKILSAW on your own work TODAY! See for yourself how many sawing jobs it does... faster, better and at lowest costs... on wood, metal, stone, concrete and compositions. Your distributor will gladly demonstrate SKILSAW for YOU... Phone him NOW!

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(Continued from page 80)

the rear end of the mucking machine; this hoist pulls the empty car from the siding to the mucker. The locomotive pulls the loaded car away.

When a California switch rides on top of the permanent track, the whole assembly of switches and siding can be skidded along to its new position by the locomotive by simply jacking up each frog on rollers running on the lower track. Moving a switch takes about 30 min. Thus it is an easy matter to keep the siding at the correct distance from the face for rapid car changing.

Spur Switch

Occasionally in small tunnels a spur, Fig. 19, is used for holding the empties. The spur is set in a wide spot in the tunnel, or an enlargement is made especially for it. This spur should be long enough to accommodate a string of empties, and should have a decided grade, 2 per cent or more, leading toward the main line. After the locomotive has taken away a loaded car from the mucker it retreats until it clears the spur switch. An empty car then is allowed to run down the grade on to the main line, where the locomotive pushes it ahead of the loads to the shovel for filling.

Cherry Picker

The first cherry picker was a swinging boom attached to the rear of a railroad type shovel. The empty cars were shoved in on the track on which the shovel stood, Fig. 20, and were then set over on to the loading track one at a time.

Another type of cherry picker developed for small tunnels and large cars is shown in Fig. 21. A pneumatic cylinder hanging from a small trolley is used to raise an empty car about 12 in. off the rails. Car and trolley then are run sideways against the tunnel wall until they clear the main line. The trolley beam is of extra heavy pipe; a standard drill column complete with jack makes an excellent beam, cheap and compact. When the tunnel is so small that two cars cannot be passed, this device can be located at some wide spot in the tunnel.

The cherry picker is operated as shown in Fig. 22. The locomotive comes into the heading pulling a string of empties. It stops a moment to leave the hindmost car under the cherry picker, which sets it to the side; then the locomotive advances to remove the loaded car from the mucker, this car having been left there from the previous train. The locomotive then retreats until the cherry picker can set the empty car back on the track in a position for pushing ahead to the mucker. Meanwhile, the last empty car has been uncoupled under the cherry picker. This operation continues until all empties have been transferred from rear to front for filling. An empty car is always left at the mucker, when the locomotive starts for the portal, to become the first car of the next trip.

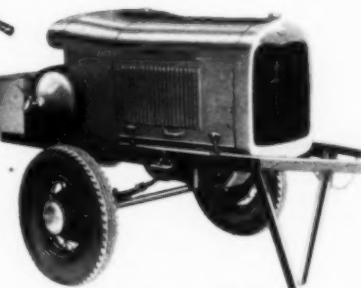
Another type of cherry picker is shown in Fig. 23A and 23B. This type picks the



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you need!*

for a majority
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you'll always be glad you bought a
SMITH AIR COMPRESSOR



Write for FREE booklet

GORDON SMITH & CO., 480 College St., Bowling Green, Ky.



YOU CAN BANK ON A BROWNHOIST BUCKET

Industrial Brownhoist buckets represent the last word in good design and construction. Light weight is combined with unusual strength. Rope wear is reduced to a minimum. Because of the clean, deep bites they take, hand shoveling is practically eliminated. Standard buckets on hand ready for immediate delivery. Write for further facts.

INDUSTRIAL BROWNHOIST CORP.
BAY CITY, MICHIGAN

District offices: New York, Philadelphia, Pittsburgh, Cleveland, Chicago

empty car up high enough to clear the train below.

Grasshopper

The King "grasshopper," used extensively on the Colorado River Aqueduct tunnels, Fig. 24, consists of a gantry about 60 ft. long, carrying a track of sufficient length to hold a train of cars. At each end of the gantry is a hinged drawbridge which, when lowered, connects the top track with the main line. When the locomotive arrives pushing a string of cars the rear drawbridge is lowered and the entire string of empties is pulled on to the overhead track by means of a hoist. The locomotive stays on the main track and pulls the loaded cars away from the mucker. The empties are run down the forward drawbridge as required, and are allowed to coast to the shovel.

The grasshopper is supported on a movable framework which straddles the muck track and operates on a wide-gage track; the whole assembly can be rapidly run back when shooting. Many contractors have mounted the rock drills on the front end of the grasshopper, which then serves as both drill jumbo and car changer.

Loading Conveyor

The Dixon conveyor consists of a belt conveyor, 36 in. wide and about 70 ft. long. The rear 50 ft. of conveyor is horizontal, carried on a gantry frame running on wide-gage rails, permitting the empty muck cars to be run underneath, Fig. 25. The front end of the conveyor is inclined, but can be raised to a horizontal position by means of pneumatic cylinders to clear the mucking machine.

The mucking machine loads directly into a boot hopper at the forward end, Fig. 26, and the muck is carried back into the empty cars. The Dixon conveyor is not actually a car changer; instead, it enables an entire train to be loaded without switching. The only delays in this system are caused by waiting for the next empty train to arrive from the nearest passing track. The rig can also be used as a drill carriage by providing drill mountings at the front end.

★ ★ ★

Underground Garage

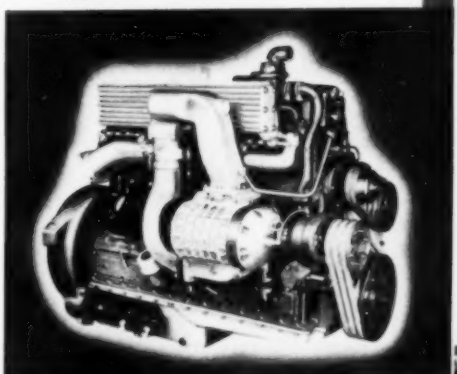
(Continued from page 55)

were put in locations where they would avoid interference with the concrete columns running up through the successive floors of the building. Interference with pouring the floor slabs, however, was unavoidable and particular attention had to be given to placing the floor reinforcing steel as well to the finishing of the concrete

(Continued on page 84)

There'll NEVER Be a Shortage in the demand for dependability

CUMMINS
Dependable
DIESELS



Today—a contractor may face a shortage in men, material or equipment . . . but never in the need for proved power . . . assured dependability.

This doesn't mean power "proved" and dependability "assured" on the test block . . . the soft snaps . . . the 40-hour week. This means power *proved* and dependability *assured* by a 9-year record on the tough jobs . . . in the muck and mire . . . on the gruelling grades and under the engine-killing loads . . . in any weather and at all altitudes. This means full-rated power at the wheel 24 hours a day and 7 days a week . . . faster work cycles . . . uninterrupted operations. This means Cummins Diesel power.

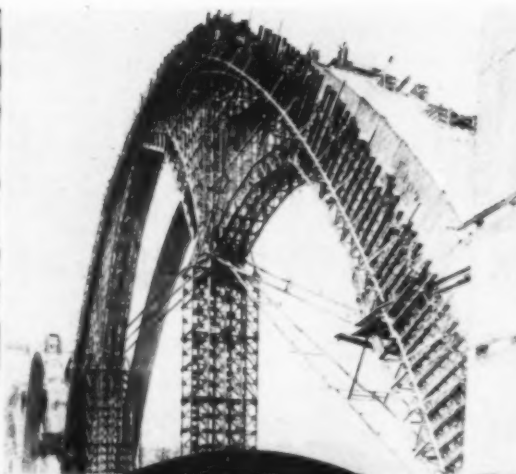
Yesterday, a delay on the job hurt only you. Today, a delay on the job hurts America. Make every minute and every hour count by specifying Cummins Dependable Diesels for your heavy-duty equipment. Cummins Engine Co., Columbus, Indiana.

LEFT, ABOVE: Frank W. Albert, Bigler, Pa., operates a pair of 2½-yard Lima 1201 Shovels, each powered with a Cummins Diesel.

LEFT, CENTER: Four Super C Tournapulls of 12-yard capacity, all powered with Cummins Diesels, are working on the Savage River Dam at Luke, Maryland.

LOWER, LEFT: Model HBS-600 (Supercharged) Cummins Dependable Diesel. 200 hp at 1800 rpm.

BELOW: One of six 14-yd. bottom dump Euclids, all powered with Cummins Diesels, which T. E. Connolly, Inc., San Francisco, is using on the Cottage Grove Flood Control Dam on the Coast Fork of the Willamette River.



for Economy in Construction

BLAW-KNOX STEEL FORM
Engineers offer a consultation service before plans are drawn, with the thought in mind that their specialized knowledge and experience may be of assistance to both engineers and contractors in promoting speed and economy in construction, and securing a superior quality of finished work.

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*Exclusive Features
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- 4—Labels die pressed into wood in two colors.
- 5—D Handle shovel equipped with the famous ABW Armor-D Handle.

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Ask your Jobber

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NORTH EASTON, MASS.

(Continued from page 83)

surface around these timber braces. To prevent water absorbed in the timbers from causing swelling that would damage the adjoining floor slabs, $\frac{3}{4}$ -in. fiber-board was tacked around the timbers in advance of pouring concrete so that there would be no direct contact between concrete and timber. Some of the floor reinforcing was thrust through holes bored in the timbers and other bars were deflected around the timber as in reinforcing around openings through floor slabs.

Bulkhead Bracing Timbers Sawed Off

When the pouring of the concrete floors, beginning with the fourth floor level below street surface, has proceeded to a stage where the bulkhead bracing timbers will no longer be needed, the plan is to saw these off just above and just below each floor level. The wood is split out carefully from around the reinforcing bars that pass through the timbers. These bars will then become the supports for patches in the floor slab that will fill in the holes left by removal of the timber.

The concrete in the floor slab is being vibrated with Mall gasoline engine-driven vibrators and the floor slab is surfaced with a Kelly motor-driven surfacing machine prior to finishing by hand.

Timothy L. Pflueger is the architect; Huber and Knapik are the structural engineers and contract for construction is held by McDonald & Kahn, San Francisco, for whom L. H. Nishkian designed the bulkheading. C. Beustad is superintendent of construction for the contractor.

★ ★ ★

Denver Ordnance Plant

(Continued from page 68)

too, the small, scattered individual concrete structures for ammunition storage and mixing propellant charges are covered with thick earth blankets, calling for the excavation of earth from borrow-pits and its transport to points of application as protective embankments. Grading and surfacing were also required for 12 mi. of highway within the plant area, in addition to earth moving operations for installing 9 mi. of railroad track.

Night Illumination

To provide illumination for carrying on construction at night as well as during the day, the contractor installed an extensive system of flood-lights. The entire plant area is inclosed by wire fencing. Drinking water stations, equipped with supplies of individual paper cups, are spotted throughout the job area for the

(Continued on page 86)



TUNNEL LINING JOB GOES THROUGH WITHOUT DELAY WITH STANDARD DIESEL FUELS AND LUBRICANTS

The two most important pieces of equipment used by an Indiana contractor on the tunnel lining job pictured here were his Diesel driven compressors. Over 2,000 yards of rock had to be removed with air hammers. Any failure in the Diesels would stop all work.

When the job was finished, these engines had operated two shifts a day for over three months without a forced shutdown.

Right at the start of the job, this contractor eliminated a lot of trouble-making factors. He called in a Standard Oil Engineer. The correct fuels and lubricants were recommended for both the Diesel and gasoline powered equipment. The necessary storage facilities and approximate delivery schedules were determined.

Then, with clean fuel and the right lubricants, always on hand when needed, equipment failures were cut to the minimum.

If you are located in the Middle West, or plan to take over a contract there, see a Standard Automotive Engineer before you start the next job. He may have many suggestions that will be profitable to you.

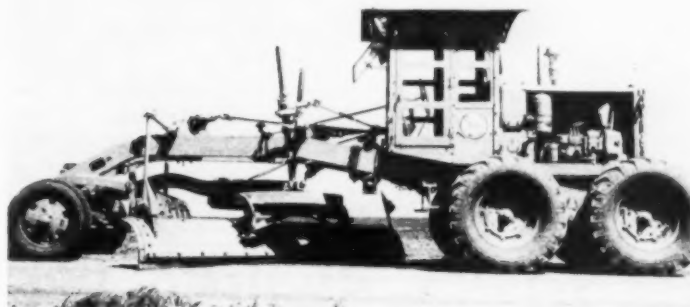
HERE'S WHAT A STANDARD AUTOMOTIVE ENGINEER CAN DO FOR YOU NOW!

Right now your gasoline and Diesel powered equipment may not all be busy on the job. If so, now is the time to see what a Standard Automotive Engineer can do for you.

Put him to work with your maintenance men. See if his experience with fuels and lubricants and his instruments for locating the weak spots in inefficient engines won't help your men speed up the reconditioning of your fleet.

Any special problems of engine varnish, oil sludging, or high fuel consumption can be analyzed more thoroughly now than when equipment is in the field.

This service costs nothing, but it may help you avoid breakdowns when your equipment is on the job next season. You can reach one of these Engineers by writing the Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, write the Standard Oil Company of Nebraska at Omaha.



COLD-WEATHER STARTING NO TROUBLE NOW FOR A MINNESOTA COUNTY HIGHWAY DEPARTMENT

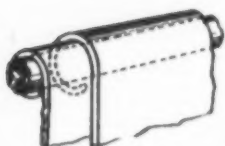
Snow piles high and the thermometer dips low about this time of year in northern Minnesota. But neither one is an obstacle now to a certain well-equipped county highway fleet in this region. There was a time when all the fine Diesel-powered snow-fighting equipment was threatened with being snowbound. Sudden cold snaps caused clogged Diesel fuel filters. It was almost impossible to start the engines.

But that's all changed. A Standard Automotive Engineer tested Stanolox Diesel Fuel on this equipment. The low pour point of Stanolox gave easy starting even at subzero temperatures.

Copr. 1942, Standard Oil Company (Indiana)

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AUTOMOTIVE ENGINEERING SERVICE

LOWERS
MILEAGE
COSTS



REINFORCED EDGE:

Upper edge of tray reinforced by heavy steel rod (butt-welded), over which steel tray-sheets are rolled . . . and wherever tray-sheets lap, both thicknesses are rolled around rod, forming double reinforcements.

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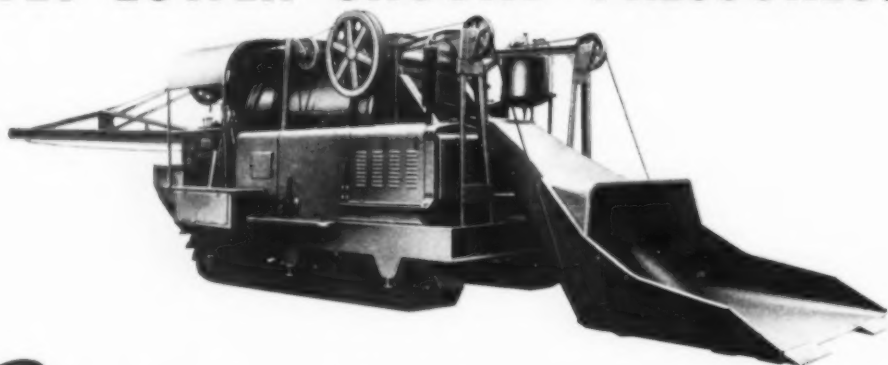


You can't go wrong in figuring costs when you use good old **STERLING** wheelbarrow "Easy Wheeling" methods. Simple, flexible, reliable . . . no "hidden costs" to upset your estimates . . . low initial investment; long service; small upkeep cost. It's wise today to simplify! Simplify your cost estimating, and simplify every job . . . ask Sterling how, now!

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Wheel: All steel (or solid rubber or pneumatic tired); Welded tray (no rivets); Continuous, butt-welded rod around top edge; V-Front braces, cross support; Channel Steel Legs, with steel shoes; Unbreakable malleable iron wheel-guard; Heavy malleable iron wheel-bracket and cold rolled steel axle; Northern hard maple handles (or tubular steel); Inter-changeable parts . . . **STERLING QUALITY** in every detail.

Bigger Pavers — Longer Booms YET LOWER GROUND PRESSURES!



Ransome 34E Single and Dual Drum Pavers

In designing its latest 34-E Single and Dual Drum Pavers, Ransome has given the Road Building Industry machines capable not only of producing a better and more uniform concrete faster than it has ever been done before, but also providing the longest possible boom reach together with the lowest possible ground pressure.

For those engineers interested in this vital subject in highway construction, we have prepared a series of charts which will readily demonstrate Ransome's contribution to higher road paving speeds with greater paver operating stability.

Copies of the charts will be mailed upon request.



RANSOME CONCRETE MACHINERY COMPANY
DUNELLEN NEW JERSEY

(Continued from page 84)

convenience of the workers. A chain of refreshment stands, operated by a local concessionaire, offers for sale cold drinks, sandwiches, cigarettes and candy. To police the plant a force of nearly 200 guards, mostly ex-service men, functions under the command of Capt. J. F. Brantley. Prior to employment, every construction worker, for purpose of identification, is photographed and finger-printed.

The Denver Ordnance Plant is commanded by Lt. Col. Duncan G. McGregor, with Major Seth Wiard as executive officer, and is being operated by the Remington Arms Co., of Bridgeport, Conn., under the supervision of E. E. Swensson. Its construction by Broderick & Gordon, contractors, of Denver, Colo., was supervised by Lt. Col. Carl H. Jabelonsky, constructing quartermaster.

★ ★ ★

Seven Month Schedule

Completes Building for Ford Bomber Plant

(Continued from page 47)

but excluding a 40-ft. strip reserved for engineering and other facilities along the 1,280-ft. west wall of the structure, is utilized for manufacturing. In that portion of the manufacturing area measuring 1,200 ft. in length are four 60-ft. crane bays and one 40-ft. bay equipped with a mezzanine locker floor. The shorter section of the manufacturing area, 500 ft. long in the north-south direction, has three 60-ft. crane bays and two 40-ft. crane bays, one of the latter bays carrying a mezzanine locker floor above a low-level craneway which provides 15½-ft. vertical clearance under the bridge crane.

Remaining bays of the entire building, comprising in each instance two 20-ft. aisles between columns spaced on 20-ft. centers in both directions, are utilized for mezzanine floors and locker floors above the first floor. To provide safe, easily controlled employee access to the building, six overhead bridges cross a concrete driveway and railroad tracks on the south side, where the parking fields are located, and tie into the building frame approximately on the level of the upper locker room floor in the south bay. The bridges extend inward parallel with the roof trusses to a second locker room floor in a 40-ft. bay separating the sub-assembly area on the south from the major assembly area in the heart of the building.

At the outer end of the bridges are

(Continued on page 88)

LIMA

IN DEFENSE WORK

VICTORY today depends not only on man-power, but on transportation and construction as well. Without these two important factors our defense efforts could not succeed. Man-power, supplies and materials must move swiftly over railroads to and from army camps and factories engaged in defense work. New air fields, cantonments, munition factories and highways must be built—which necessitates excavating equipment. It is here that LIMA enters the first line of defense. LIMA locomotives are the prime movers of long trains carrying supplies and materials to all parts of the country, while LIMA shovels, draglines and cranes are speeding up important defense jobs everywhere. LIMA is proud of its record. To our customers working on defense projects and to those maintaining the backlogs of the construction industry, we extend greetings and best wishes.

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FIRST LINE OF DEFENSE

LIMA

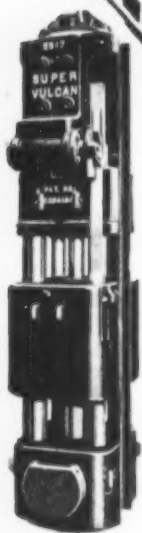
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DAGLINES, VARIABLE

CRANES, 13 TONS to 60 TONS

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DOLLARS
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FARTHER



SIZES
18C — 30C
50C — 80C
meet all needs

*Therefore
You Save
More Money
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Piles with a*

SUPER-VULCAN OPEN TYPE

**DIFFERENTIAL-ACTING
PILE HAMMER**
18C, 30C, 50C and 80C

Here's how you benefit—you use 25% to 35% less steam per blow—you get twice the number of blows per minute—you drive more piles at less cost—you get easier operation, more dependable performance, and longer service. Fits the same leads—and uses the same accessories as the Vulcan Single-Acting Pile Hammers. Write and get all the important facts.

VULCAN IRON WORKS
Since 1852
331 North Bell Avenue

Chicago



Illinois

(Continued from page 86)

watch towers for plant guards and elevators to raise lunch wagons to deck level. Lunches will be delivered in these rolling wagons across the bridges and into the building at mealtime. Toilet rooms are provided on upper floors in the 40-ft. bays for each 38,000 sq. ft. of floor area. Provision of these facilities, plus close control of pedestrian movement over the bridges, is relied upon to avert danger of any willful damage to machinery at times when full supervision is not present on the manufacturing and assembly floors.

In the assembly building, transportation of parts and assemblies will be by overhead electric-powered monorails. The American Monorail Co. is installing mile upon mile of overhead carrier tracks under an \$800,000 competitive-bid contract.

Expansion of Plans

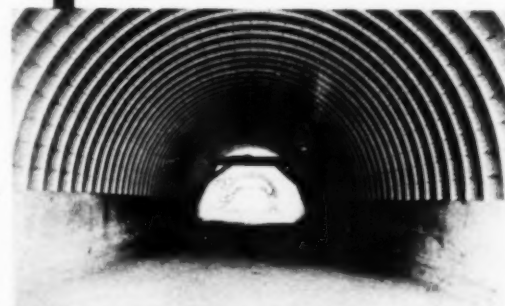
Original plans for the bomber plant proposed an L-shaped building measuring 880 ft. in the short leg and 1,720 ft. in the long leg. Later additions to the plans increased the overall length of the short leg to 1,280 ft. and the overall length of the long leg to 3,120 ft.

Urgent demand for rapid construction caused difficulties which are fairly typical of practically all defense projects. Preliminary sketches were made by the architects and approved by the owner. Structural steel drawings were prepared with great rapidity, and the architectural drawings were developed coincidentally by a large staff of architects and engineers. Steel bids were taken and contracts let while excavation plans were being completed. Contracts for the architectural trades were awarded while steelwork was being fabricated. The foundations were ready by the time the steel was delivered for erection. Despite these complications, inescapable on high-pressure jobs, the architects, engineers and constructors managed operations so skillfully that the entire working force and all equipment units delivered close to capacity production throughout the course of the job.

Two Types of Contracts

For the original 880x1,720-ft. L-shaped building, designated as Section 1 in the revised progress schedule for the enlarged plant, the Ford Motor Co. in the spring took competitive bids for all trade divisions except plumbing, heating, ventilating, electrical work and fire protection. Work on excavations, footings and walls below grade in Section 1 was started in the second half of April on orders from the Ford Motor Co. to the low bidder, although a formal contract was not signed until July 20, 25 days after the Defense Plant Corp. took over the project. July 20 was the earliest date for the award of any formal contract; several contracts were awarded on that date, and all the remaining contracts were awarded by August 15. With the exception of the work started in Section 1, late in April, actual construction operations by the various trade divisions

Commercial



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tunneling need ...*

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COMMERCIAL LINER PLATES, featuring safety, ease and economy of installation, are here used in underpass construction on the Maricopa-Ventura highway in California. Note the neat appearance . . . the perfect safety these COMMERCIAL Plates provide.

COMMERCIAL plays an important part in lowering the cost of highway construction that requires underpasses. Investigate these time and money saving plates . . . they'll do your job regardless of tunnel size or ground conditions. Write for our latest catalogs and familiarize yourself with the complete COMMERCIAL selection of Liner Plates and Tunnel Supports.

**The COMMERCIAL SHEARING &
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Rex Speed Prime Pump
on overpass job.

**WISCONSIN
HEAVY DUTY
Air-Cooled
ENGINE
AT WORK**

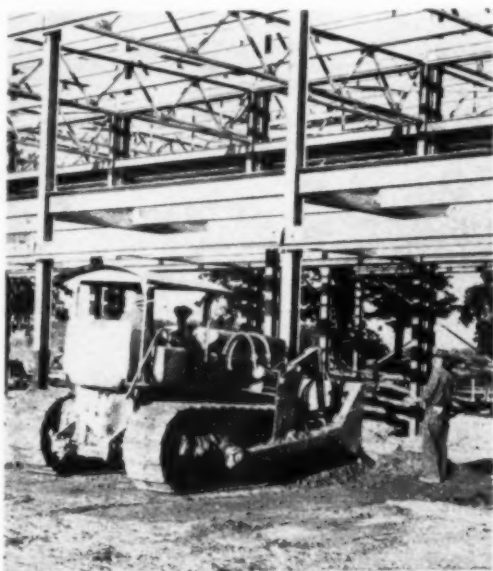
Stepping up and
maintaining work
schedules during
these days of high

pressure production in all lines, requires equipment of maximum dependability and efficiency. Because Wisconsin Engines (1 to 35 hp.) are built for heavy-duty service; because they are air-cooled; because they are compact in design; extremely light in weight; equipped with weather-sealed outside magneto with impulse coupling for quick starting in any weather; because they run on Timken roller bearings . . . Wisconsin Engines AT WORK today, are increasing productive capacity wherever they are in use.

WISCONSIN MOTOR
Corporation
MILWAUKEE, WISCONSIN, U. S. A.
World's Largest Builders of Heavy-Duty Air-Cooled Engines

on the project got under way at various dates from August 5 to September 21.

Contracts for a number of elements of the job were awarded as a result of the competitive bids, many of them on a lump-sum basis. Cost-plus-fixed-fee contracts, awarded after taking prices to determine budgets and estimates, were drawn up for four principal divisions of the project: (1) general masonry and architectural trades and coordination of all trades on the job, (2) electrical work, (3) plumbing and heating, and (4) ventilating. Provisions relating to the fee in the first contract are typical of other fixed-fee contracts on the job. The base fee named in the Bryant & Detwiler general contract was predicated on the contractor's low bid in the original proposal, exclusive of additional costs for overtime, winter protection and defrosting of frozen ground for concrete placement. Sums based on estimates for these additional items were set up in the budget, and



TRACTOR-BULLDOZER of Charles J. Rogers places backfill outside foundation wall.

the fee schedule was graduated in accordance with increases in overall cost occasioned by extra work items.

Foundations and Tunnels

First contractor to start work on the bomber manufacturing and assembly building was the J. A. Utley Co., Detroit, which was given an order in April to begin construction of foundations and tunnels in Section 1. On the basis of prices quoted in its original proposal, this firm on July 20 was awarded a contract of a total value of \$600,000 to include all foundation and tunnel work for the entire building. For the complete plant, the work involved nearly 2,500 concrete footings for columns, some 10,000 lin. ft. of grade beams, or foundation walls, between footings and more than 5,250 lin. ft. of reinforced-concrete box tunnels to carry steam lines from the power house to various parts of the building. The tunnels, 6½ ft. high by 8 ft. wide, inside dimensions, have 10-in. walls and 9-in. roof and floor, the floor slab being laid on a concrete mud mat. Walls and roof are protected by membrane water-

(Continued on page 90)

GOOD TOOLS are the Sword Arm of Industry



WHETHER it be defense against aggression or insurance against the encroachment of business competition, good tools are vital weapons of industry. Today, America's tool makers face a critical responsibility in keeping industry efficient. We, at Williams, who are striving to do our part, find satisfaction in the knowledge that the rigors of this hour are equipping us better to serve old and new friends in the years to come.

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WILLIAMS
SUPERIOR DROP-FORGED TOOLS

Headquarters
for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS



BUILT TO LAST AND MOVE DIRT FAST

WELDED ROLLED STEEL CONSTRUCTION



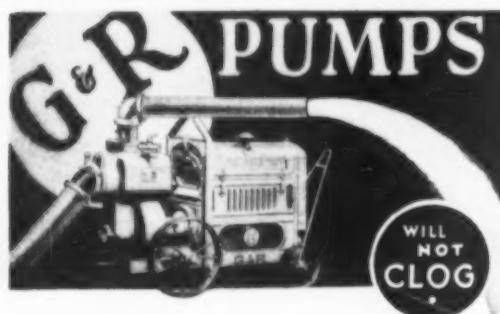
Cuts down excess weight, yet assures greater strength at vital points. Rivets used only at sections where quick replacement may ultimately be required. This welded construction, with other important features of Williams design, makes possible broader guarantees of long, profitable service.

Write for individual bulletin covering each type of Williams Bucket

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WILLIAMS *Buckets*

built by WELLMAN



The Most DEPENDABLE Pump For The Least Money

Claims of fastest priming, highest suction lift, more gallons per minute, etc., do not pump water. On the job, the pump must do its own talking, and with dirty water, many a pump is inclined to stutter—and stop.

Let G & R Pumps tell you their own story on any job. They will deliver as much, and usually more, water under any condition, than any other pump. We will ship you one and let you be the judge.

Remember this about G & R Pumps—THEY WILL NOT CLOG—THEY ASK NO TIME OUT. Play safe! That is why more contractors are standardizing on G & R Pumps than on any other make.

Distributors in 100 principal cities are ready to make prompt delivery of the G & R Pumps you need.

THE GORMAN-RUPP CO. Mansfield, Ohio

ABCO COVERS are

Waterproof & Mildewproof!

★ ★ ★

We manufacture a specially treated cover that is thoroughly water and mildew-proof. This material is high in tensile strength and capable of withstanding severe abrasion conditions.

★ ★ ★

Write for further information

AMERICAN BRATTICE CLOTH CORPORATION

WARSAW, INDIANA

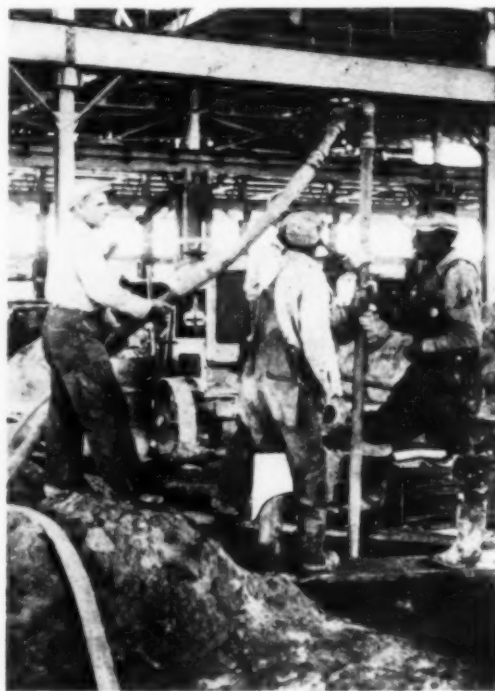
(Continued from page 89)

proofing covered with a 1-in. coat of cement plaster.

Predraining Ground

Under the thin topsoil at the site is a layer 4 to 5 ft. thick of coarse sand resting in general on a layer of hard clay which varies in thickness from 0 to 4 or 5 ft. Below this clay is a 4-ft. average thickness of fine sand or silt ending at a depth of 15 to 18 ft. below grade on a hard clay stratum. Normal groundwater level is high, rising to within 2 or 3 ft. of the surface.

Soil and groundwater conditions invited the use of well points for predraining the ground, and the various contractors operated several dozen Moretrench well-point systems in and adjacent to the manufacturing and assembly building to lower



USING PUMP to supply water under pressure, Bryant & Detwiler crew jet 18-ft. well point inside building.

the groundwater level and permit excavation and construction of deep foundations, tunnels and footings in the dry.

In addition to a large number of Moretrench well-point systems used by the J. A. Utley Co. and by Bryant & Detwiler, the Gargaro Co., Detroit, holder of a \$157,000 contract for plant sewers, employed similar equipment to predrain the sewer trenches. The Gargaro firm also executed a \$55,000 contract for water mains. Drinking water is being brought into the plant 4 mi. from Ypsilanti through a 12-in. pipe, and a supplemental supply of treated drinking water has been developed by sinking 26-in. wells at Rawsonville, about 2 mi. from the plant, on the Huron River. Industrial water for plant use will be taken from an impounded lake at Rawsonville.

At the site of the sewage disposal plant, constructed in an excavated hole in the high ground forming the north bank of Willow Run, Couse & Sanders used a different drainage method. The excavation penetrated to a considerable depth into the

(Continued on page 92)

Thank You...

- Your confidence in us in the past year has increased our business many times over that of any of our twenty-eight years of service to the American contractor.

- We are constantly striving to better our products and service to keep them up to the high standard of your requirements.

- Our network of branches and distributors are as close to you as your phone. Their complete stocks are an overnight distance from your job.

- Our nationwide staff of engineers are at your call, ready and qualified to solve your problem with you or for you.

- We have kept above the confusion of the past year to the end that we are proud of our timely shipments regardless of priority or size of the order.

- We shall continue to serve you in this manner so that we can hold that cherished confidence you have shown us . . . so that next year we can say again as we say now . . . thank you.

UNIVERSAL FORM CLAMP CO.

E. Lampert Mayers, PROP.

Concrete Forms and Form Ties and Reinforcing Steel Accessories

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MORE HP HRS. PER \$

for your pumps . . . hoists . . . mixers
. . . loaders . . . crushers . . . finishers



LE ROI D201

A gasoline engine that upholds Le Roi's reputation for dependability. • *Overhead valve arrangement* assures quick accessibility, fuel economy. *Hardened valve seat inserts* minimize need for valve adjustment. *Removable wet sleeve cylinders* assure uniform expansion and true cylinder bores. • One of a complete range of Le Roi engines — 4 to 400 horsepower. Look for — ask for — Le Roi power when you buy equipment.

Write for free Bulletin 201C.

LE ROI COMPANY • Milwaukee, Wis.

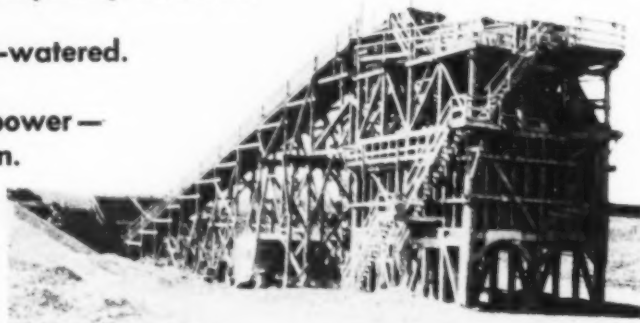
3 Reasons why You're ahead with

Reliance

SAND and GRAVEL Washing and Handling Units

- ① Foreign substances completely removed.
- ② Sand thoroughly de-watered.
- ③ Saves head room, power — simplifies distribution.

The best results in cleaning sand and gravel are obtained through the use of Reliance System Revolving Screens and Paddle Type Boxes. Clay, loam and other foreign matter is completely removed and floated away. The sand is de-watered while being carried to the storage bin. The single sizing screen saves head room and power and simplifies distribution to storage. Send for Catalog No. 11.



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Distributors in ALL principle cities of the U. S. A.

RELIANCE PRODUCTS

Reliance offers a complete line of Rock Crushers; Bucket Elevators; Revolving Screens; Storage Bins; Pulverizers; Chip Spreaders; Heating Kettles; Bin Gates; Feeders; Belt Conveyors; Grizzlies; Air Separators; Sand and Gravel Spreaders; Wash Boxes.

(Continued from page 90)

impervious clay stratum. At the top of this impervious layer, the banks of the excavation were stepped back to form a bench, and drain tile was laid in a shallow ditch cut in the clay and backfilled with gravel to intercept groundwater seeping out of the sand and silt. The drains discharged toward Willow Run through breaches cut in the high creek bank.

Structural Steel

On the basis of a competitive unit bid price per pound for fabrication and erection, Whitehead & Kales, Detroit, are completing a contract valued at about \$3,000,000 for 27,000 tons of structural steel in the main building, 4,400 tons in the hangar building, and 710 tons in the power house. Structural members and trusses shop-fabricated in large units were delivered to the job on truck-trailers for unloading and erection by cranes. In the northwest portion of the assembly area (Section 3 of the progress plan), an Industrial 60-ton steam locomotive crane unloaded and stocked fabricated steel units in a temporary storage yard. Six Industrial gasoline crawler cranes, five of 15-ton capacity and one of 25-ton capacity, and two Universal heavy truck-cranes with long booms erected the steel. At the end of September, when working one shift, Whitehead & Kales employed about 200 men in erection and riveting gangs.

General Contractor

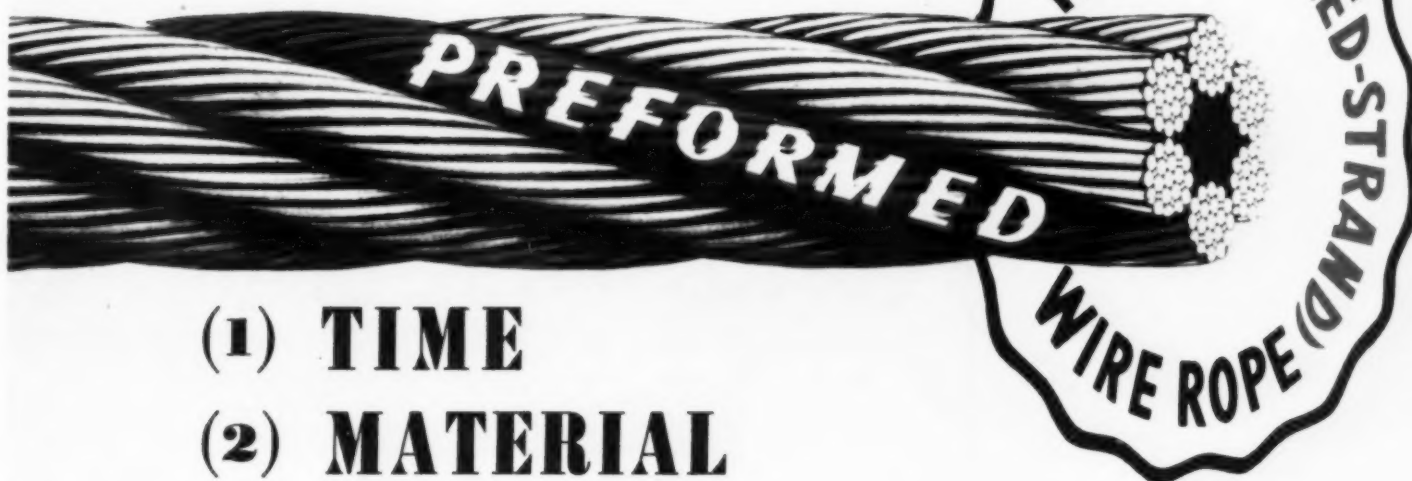
On its \$5,000,000 fixed-fee contract, which included construction by general masonry and architectural trades and coordination and expediting of all trades on the job, the Bryant & Detwiler Co., up to September 22, operated two shifts five days a week but planned to work six days, as also did practically all other contractors on the job, as soon as an agreement could be reached on a labor overtime rate of time-and-one-half, the maximum rate which the government was willing to pay. For a while Detroit's building trades locals resisted acceptance of this overtime rate; they wanted to retain the double-time concession obtained after many years' effort, their desire being prompted in part by a fear that a reduction on this job would lead to a general reduction in the Detroit area.

On September 17, the total payroll for the entire project, including the airport, was 2,909 employees. Of this number, nearly 2,200 were engaged on construction of the manufacturing plant. The Bryant & Detwiler Co. had 690 on its own payroll and more than 130 on the payrolls of sub-contractors working directly for the firm. Other contractors on the job employed the remainder of the working force.

In its position as job coordinator, the Bryant & Detwiler Co. installed a central telephone switchboard manned by two operators to take care of 70 lines. The switchboard equipment includes a microphone connecting with a loudspeaker system which summons men on the job to the

(Continued on page 94)

A Timely 2-Way Saving With



- (1) TIME
- (2) MATERIAL

How can production be speeded? How can essential materials be best conserved? These, today, are vital questions.

With wire rope, the answer is in using the quality, construction and type that can be installed the quickest . . . that will last the longest, and thus do the most work for the amount of materials employed.

You can depend on Preformed "HERCULES" (Red-Strand) Wire Rope for this 2-Way Saving. It not only lasts longer — which means fewer replacements — but because it is easier

to handle, it can be installed more quickly. It provides all the advantages of the preforming process, *plus* the inherent qualities and advanced manufacturing methods that have long since caused the "Red Strand" to be recognized as the sterling mark for wire rope.

Why not take advantage of this 2-way saving? In doing so you will also be reducing your operating costs, for the principles that make "HERCULES" long lasting, also make for maximum economy.

Preformed "HERCULES" (Red-Strand) Wire Rope is furnished in both Round Strand and Flattened Strand constructions. In this one grade there is a right rope for every heavy duty service.

MADE ONLY BY A. LESCHEN & SONS ROPE CO. WIRE ROPE MAKERS 5909 KENNERLY AVENUE				ESTABLISHED 1857 ST. LOUIS, MISSOURI, U. S. A.	
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Manufacturers of Safety Fuse since 1836

PRIMACORD-BICKFORD DETONATING FUSE



It Won't Happen Here!

with Universals on the Job

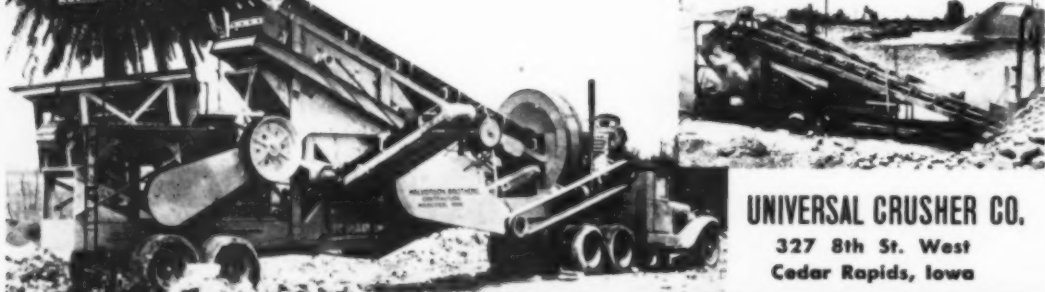
In World War I the A.E.F. spent half its time digging itself out of chuck holes and wallows — hydroplanes could land on airports almost all the time. That was over there!

But it won't happen here, thanks to Universal Portable Crushing Plants which are turning out specification chips, aggregates and base course material for hundreds of airports, camps, naval bases, access roads and other defense projects.

Universals are patriotic because they turn out material faster, require fewer repairs, thereby saving strategic materials and they conserve fuel! You can do more for Uncle Sam and do better for yourself with a Universal. Everything for crushing, pulverizing, screening, loading, washing and storage.

Triangle Construction Co., Boise, Idaho, chose a Universal Jaw Crusher for their concrete plant (on right) to make material for Walla, Walla, Wash. airport. Averages 3,000 tons a day.

Below: "Pacemaker" Quarry Plant with "Two-in-One" Roller makes high yardages of defense material at low cost per yard for Halverson Bros., Rochester, Minn.



UNIVERSAL CRUSHER CO.
327 8th St. West
Cedar Rapids, Iowa

UNIVERSAL

CRUSHERS, PULVERIZERS, COMPLETE PLANTS, SPREADERROLLERS, PORTABLE ASPHALT PLANTS

(Continued from page 92)

nearest of five telephone booths scattered about the project.

Concrete Plants

Concrete requirements under the Bryant & Detwiler contract total 95,000 cu.yd., of which 65,000 cu.yd. is in 8-in. floor slab for the 62-acre ground area of the manufacturing and assembly building. This slab calls for reinforcement with two layers of 6-in. welded wire mesh; more than 5,000,000 sq. ft. of mesh is required. In addition to first floor slab laid on ground, the building includes also 800,000 sq.ft. of mezzanine and locker floors consisting of concrete slab reinforced with bar steel and supported on I-beam joists.

Executing a subcontract to supply all concrete for the Ford Motor Co. work, the Julius Porath & Son Co., Detroit, early in the job erected beside a railroad spur a



CONCRETE COVER for electrical conduits installed inside forms is delivered in 2½-yd. truck mixer for J. A. Utley Co.

temporary batching plant to feed a fleet of about ten Jaeger 4-yd. truck mixers. This plant served during the time required to install a permanent Erie plant comprising 350-ton bins and batching equipment capable of measuring out a 4-yd. batch every 50 seconds. The agreement with the concrete supply firm calls for delivery of 1,000 cu.yd. in an 8-hr. shift, or 2,000 cu.yd. in 16 hr.

For winter operation, the batch plant is inclosed and equipped with steam heating lines supplied from boilers. A larger truck-mixer fleet operates from this plant, which furnishes heated batches, including mixing water, to the mixer units.

Cement is hauled to the plant by the Hess Cartage Co. in special bulk cement truck trailers of 100-bbl. capacity equipped with two screws for unloading. To keep down the weight per axle for highway transport, the trailers haul only 60

(Continued on page 96)

3/8 TO 3 YARD CAPACITY

LINK-BELT SPEEDER

**SHOVELS—DRAGLINES
CRANES**

IN THE *Front Lines* OF DEFENSE



ELEVEN

**Link-Belt Speeders
Rush Construction
at New River
Ordnance Works
in Virginia**

Over 200 structures, including administration buildings, big warehouses, machine shops, huge factory buildings and many large, re-inforced concrete powder-igloos . . . over 60 miles of roads, a complete sanitation system . . . all of this covering 4,500 acres—that is New River Ordnance Works.

Eleven Link-Belt Speeder shovels, draglines and cranes have been working two 10-hour shifts day in, day out, to speed construction on this gigantic defense project. The machines handle aggregate, dig ditches, level ground, pour concrete and have been doing general crane and lifting work.

New River Ordnance is just one of many Defense Projects where Link-Belt Speeder machines play a vital part in speeding construction. Contractors throughout the nation rely upon Link-Belt Speeders for speedy and consistently dependable performance.

There are twenty-one different models in Link-Belt Speeder's line of shovels-draglines-cranes. Write today for full particulars.

8745

LINK-BELT SPEEDER CORPORATION

Builders of the Most Complete Line of Shovels and Cranes

301 WEST PERSHING ROAD

CHICAGO, ILLINOIS

ELEVATED STEEL TANKS for water supply systems

Elevated steel tanks provide dependable water service for camps, municipalities and factories. They store a reserve at an elevation to meet heavy demands, even though such demands exceed the capacity of the pumps and wells or other source of supply. The supply in the tank is then replenished when the demands for water are low, as they often are during the night.

A water system with an elevated tank is particularly desirable for fire protection. The supply is held above the property it protects. The force of gravity provides dependable pressure at all times even though the pumps are shut down or the power supply is temporarily interrupted.


Don't compromise when you design water supply facilities for camps, flying fields and vital industrial plants. Insist on an elevated steel tank.



CHICAGO BRIDGE & IRON COMPANY

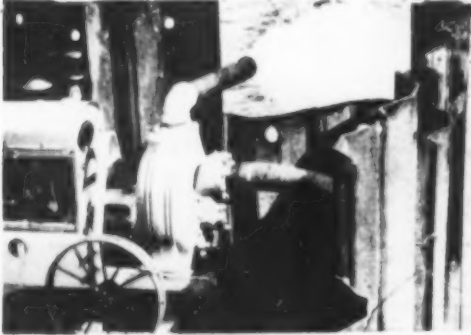
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PRIME
CENTRIFUGAL
PUMPS**

UNMATCHED IN PRIMING SPEED!
Own CMC's famous Twin Primers. They save time — save money. For big jobs or small — you can get good deliveries on all sizes from 1½ to 10".



CMC 40M — pumping 40,000 G.P.H. on Bridge Job.

Anticipate your equipment needs. Get CMC's big new catalog of Concrete Mixers, Batching Equipment, Hoe Type Mixers, Pumps, Hoists, Power Saws, Carts, Barrows.

CONSTRUCTION MACHINERY CO.
WATERLOO, IOWA



Get this
**EXTRA
VALUE**
in
SHOVELS!

**ASK
for the
ONLY
SHOVELS**
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**Blade Edges
GUARANTEED
SPLIT-PROOF**

INGERSOLL SHOVELS
"The Borg-Warner Line"

Write for Catalog and Prices
INGERSOLL STEEL & DISC DIVISION
BORG WARNER CORPORATION
NEW CASTLE, INDIANA

Plants: New Castle, Ind.; Chicago, Ill.; Kalamazoo, Mich.

(Continued from page 94)

to 75 bbl. per trip. The cement comes from the Ford plant at River Rouge.

Concrete needed by the J. A. Utley Co. for its foundation and tunnel work was supplied from a job batching plant in 2½-yd. truck mixers, mostly Ransomes, by the Ann Arbor Construction Co., which supplemented its own hauling units with truck mixers of J. A. McKay & Sons.

Grading Site

To clear woods on the site, strip topsoil, grade the entire area and excavate for the office building and garage, including the deep pit for the transformer station under the latter, the Bryant & Detwiler Co. entered into a subcontract with Charles J. Rogers, Detroit. To carry out his assign-



PLYWOOD FORMS on 3x3-in. joists supported by attached legs wedged up from I-beam flanges carry reinforced-concrete slab of mezzanine floor.

ment, which involved about 200,000 cu.yd. of earth-moving, the subcontractor operated eight draglines and four tractor-bulldozers. Deep excavation was predrained by Moretrench well points installed by the general contractor.

Walls and Partitions

Typical exterior closure walls of the assembly area are daylighted by continuous horizontal bands, 4 ft. 8 in. deep, of steel sash, one band for the first floor and another band for each of the upper floors in the outer bays. The north wall, 31 ft. 2½ in. high, has a 12-in. brick spandrel from the grade beams to the stone sill under the first course of sash, an 8-in. brick curtain from the head of this band of windows to the sill of the mezzanine sash, and an 8-in. brick spandrel from the top of the latter windows to the stone coping a short distance above the roof line. On the south side the exterior wall is 39 ft. 3 in. high, inclosing three stories in the south bay. Here the bottom spandrel is 12-in. brick, the second spandrel is 8-in. brick, and the two upper spandrils are Gunite 2 in. thick.

The latter construction is fairly typical of the outside walls of the manufacturing

(Continued on page 98)

PUSHING POWER *PLUS!*



Leveling rock or dirt . . . rooting out stumps or trees . . . tearing down banks or digging ditches—the 2-Cycle Diesel takes every job in stride. With a Baker 'dozer above . . . a Gar Wood at right!

Let 'em come! You can easily keep ahead of hauling equipment with a 2-Cycle Diesel doing the leveling. Shown here with a Buck-eye 'dozer.

Smoothest pusher-tractor you've ever seen! You "gun" it and go, with 2-Cycle Diesel power! Operator simply feeds more fuel when going gets tough . . . rarely needs to shift gears. Keeps 'em moving!

2-CYCLE DIESEL POWER

3 Sizes—HD-7, 60 h.p.; HD-10, 87 h.p.; HD-14, 132 h.p.

Sock it to 'er! That's 2-Cycle Diesel Power you are "gunning" . . . **PUSHING POWER *PLUS!*** More power than was ever before packed into an engine of similar size . . . double the power strokes—hard-hitting power that gets more done! Smoother power that purrs quietly through toughest work . . . easier on your tractor and pocketbook. Time-saving power that maneuvers into position quicker . . . with throttle control, flashing pick-up and ability to turn on its tracks in high. Money-saving power that operates on ordinary Diesel fuels. Power that puts in extra time—starts instantly and goes to work sooner . . . no need to lose ½ hour periods greasing truck wheel assembly, either. One supply of lubricant lasts 200 hours in Positive-Seal truck wheels and idlers. **EXTRA WORKING POWER . . . MORE ECONOMICAL POWER!** That's **MORE PROFITABLE POWER** . . . the kind you want! Let your Allis-Chalmers dealer show you.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE • U. S. A.

**MARVELOUS
NEW EQUIPMENT**



*moved into
the DEFENSE BATTLE
on the decks
of*

**ROGERS
HEAVY DUTY
TRAILERS**

**EXPERIENCE
builds 'em
PERFORMANCE
sells 'em**



**ROGERS BROTHERS
CORPORATION**
220 ORCHARD ST.
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SCHRAMM . . . a name that stands behind the product! A product that is aiding your Uncle Sam to build an army of defense. You'll find SCHRAMMS everywhere because owners have found that their LONG Life . . . Light Weight . . . Compact Dimensions . . . Automatic Controls . . . Efficiency . . . and Flexibility mean profitable contracts. SCHRAMMS are either gas or diesel powered and built in sizes 20, 40, 60, 85, 105, 210, 315, and 420 cu. ft. per minute of actual air delivered. ALL SCHRAMMS are water cooled for heavy duty work under all weather conditions, providing the same degree of uniformity in cooling either in extreme hot or zero weather. Choose SCHRAMM, a product worthy of its name.

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WEST CHESTER, PA.
DEALERS IN PRINCIPAL CITIES

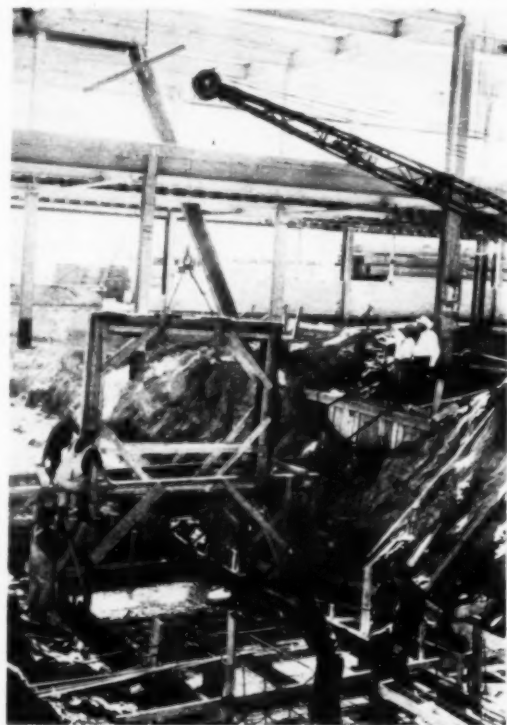
(Continued from page 96)

wing and, also, of the receiving and shipping areas. Along the entire west end of the building, inclosing the engineering section, the walls and spandrels are wholly of brick.

In exterior walls for the entire job, the general contractor is laying 1,200,000 face brick and more than 1,400,000 sand-lime backup brick. Interior rooms and partitions require a total of 245,000 pieces of glazed tile and cinder block in various sizes. Gunitite for exterior spandrels and for monitor ends is applied under subcontract by Hanna-Zabriskie & Daron, Detroit. Total area of the Gunitite is more than 300,000 sq. ft.

Roof

To cover the 59.4 acres (26,000 squares) of roof on the main building, the design calls for U. S. Gypsum steel rib deck of 16-gage sheet dipped in enamel, the deck to be covered with insulation and composition roofing. The Capital Erection & Welding Co., Lansing, Mich., erects the steel roof deck and welds each of the interlocking ribbed metal planks to the steel



PREFABRICATED EXPANSION JOINT with copper flashing installed is lowered on to concrete mud mat in tunnel trench by J. A. Utley crew.

roof purlins and to the underlying planks in the next lower row, where the ends overlap.

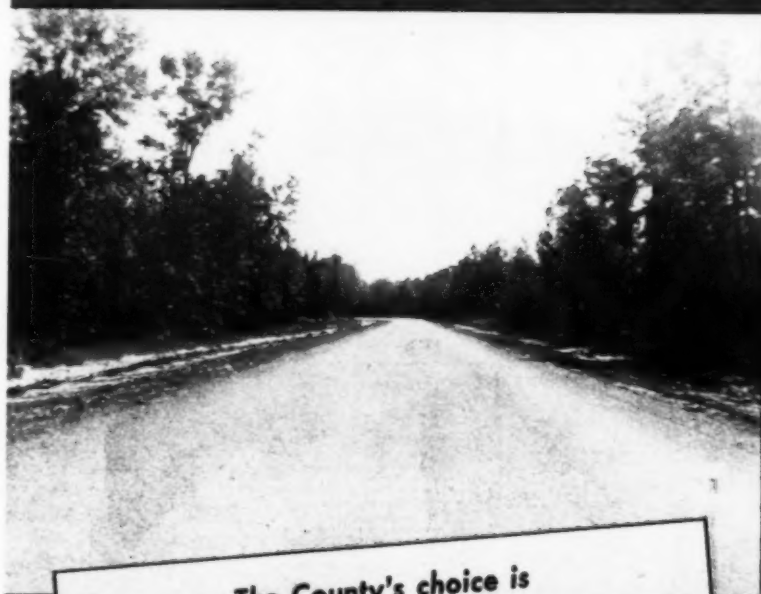
On the metal deck, the Arrow Roofing & Sheet Metal Co., Detroit, holder of a \$650,000 competitive-bid contract, lays 1½-in. J-M Rock Cork vermiculite insulating sheets and covers them with bonded Barrett built-up roofing comprising four plies of asphaltic felt membrane mopped on and topped with a layer of hot pitch and slag, the latter applied at a rate of 400 lb. per square, requiring a total of 5,175 tons for the 26,000 squares on the big building.

Pitch for the roofing contractor's crews

(Continued on page 100)

**COUNTY improves
69 miles of highways**

**COUNTY SEAT paves
170,000 sq. yds. of streets**



The County's choice is
TRIPLE ASPHALT SURFACE TREATMENT



The County Seat's choice is
ASPHALT PAVEMENT ON ASPHALT BASE

Here's more evidence of Texaco Asphalt's versatility in solving the problems of the road builder.

Montgomery County, Texas, had 69 miles of highway to build. A durable, all-weather type of construction was wanted—but the cost had to be kept down. This is how the County solved the problem:

An iron ore gravel foundation was laid to a 10-inch compacted thickness, followed by a triple application of a soft TEXACO Asphalt. The three applications, with the mineral covering on each, produced a tough, non-skid, waterproof surface about 1 1/4 inches thick.

Conroe, county seat of Montgomery County, had 170,000 sq. yds. of streets to pave. It wanted a more substantial type of construction than that used on the County's highways.

Again the need was filled by TEXACO Asphalt. A 6-inch Asphaltic Concrete pavement (1 1/2 inch surface on 4 1/2 inch base) was laid on Conroe's streets. Completely resilient from top to bottom, such "all asphalt" construction assures long service and low upkeep.

In the wide range of Texaco Asphalt road and street types, there is one exactly suited to your requirements.

T E X A C O  **A S P H A L T**

THE TEXAS COMPANY, Asphalt Sales Dept., 135 E. 42nd St., New York City
Philadelphia Richmond Boston Chicago Jacksonville Houston

For Truck Cranes Too!

HAISS
Hi-Power

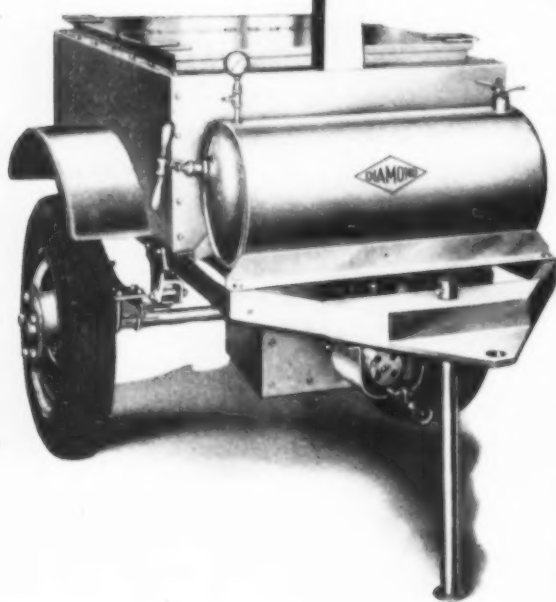


The $\frac{3}{4}$ yard Hi-Power is a bucket the truck crane man swears by — for speed, digging power and yardage. Let us quote you prices on any size from $\frac{3}{4}$ yard up.

In stock at New York, Philadelphia, Baltimore, Atlanta, Charlotte, Richmond, Hartford and Los Angeles
GEORGE HAISS MFG. CO., INC., 139th ST. & CANAL PLACE, NEW YORK—DISTRIBUTORS EVERYWHERE

For the most

efficient, low-cost heating
and handling of tar



THE NEW DIAMOND PORTABLE TAR KETTLE

For new highway and street construction, or for maintenance work, this modern, highly efficient tar and asphalt kettle meets a definite need.

Double circulated heat is furnished by a MAHR torch unit to a large combustion chamber which affords greatest fuel economy. But a few minutes are needed to light burner and have tar or asphalt ready for use. Ruggedly built for long service, yet light enough and flexible for quick, easy moving from place to place. Has many features any highway superintendent will appreciate.

The **PORTA CRANE** is the answer to many a daily problem of lifting and moving on the job. Portable. Can be hauled from place to place. Will lift and move, and can even be used as a dragline. . . . Ask for complete details and prices.

DIAMOND is making astonishingly prompt deliveries on tar kettles, Porta Cranes, crushers, screens, conveyors, etc. Write for prices and full information.

DIAMOND IRON WORKS, INC.
ESTABLISHED 1922
AND THE MAHR MANUFACTURING CO. DIVISION
MINNEAPOLIS, MINNESOTA, U. S. A.

(Continued from page 98)

is delivered hot to the job by the Barrett Co. in Tarvia tank trailers. The tank service is predicated on the use of 20 tons per day at the job. Pitch is hoisted by hand, using ropes running over pulleys mounted on tripods above roof openings. For raising slag, the contractor employs a gasoline-powered hoist mounted on a truck. This unit hoists a steel bucket holding 4 cu.ft., sufficient to fill a wheelbarrow on the deck.

Electrical Contract

Extensive electrical work covered by a \$6,500,000 fixed-fee contract of the John Miller Electric Co., Detroit, is indicated by requirements of more than 300 tons of copper cable, 130 carloads of steel conduit, $\frac{1}{2}$ - to 6-in. size, and 30 carloads of fiber duct (293,000 ft.) supplied by the Ford Motor Co., mostly in 2 $\frac{1}{2}$ - to 4-in. diameters, including G-E Fiber-duct and Brown Co. Bermico fiber conduit. Operations of this contractor, as well as those of the heating and plumbing and ventilating contractors, were fairly well represented in a pictorial story which appeared in *Construction Methods*, November 1941, p. 42.

All lighting in the entire plant is by fluorescent lamps.

Plumbing and Heating

A \$3,000,000 fixed-fee contract of the Donald Miller Co., Detroit, covers vast plumbing and heating installations, including 100 mi. of pipe for water and steam and 88 central heating units in the manufacturing and assembly building. Each of these units, capable of heating six good-sized houses, is equipped with steam coils, air filters and blower fans for forcing air through the duct system. Steam radiators are used for heating offices, toilets and lunch rooms. Equipment installed under the contract includes 5,000 plumbing fixtures.

Air Ducts

To fabricate and erect the duct system for ventilating and heating the plant, the Carlson Bros., Inc., of Michigan, Detroit, is executing a fixed-fee contract valued at \$1,360,000. Galvanized sheet metal of 16 to 26 gage is used in the ducts.

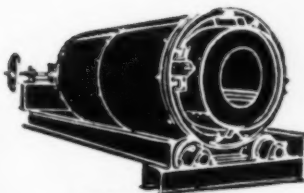
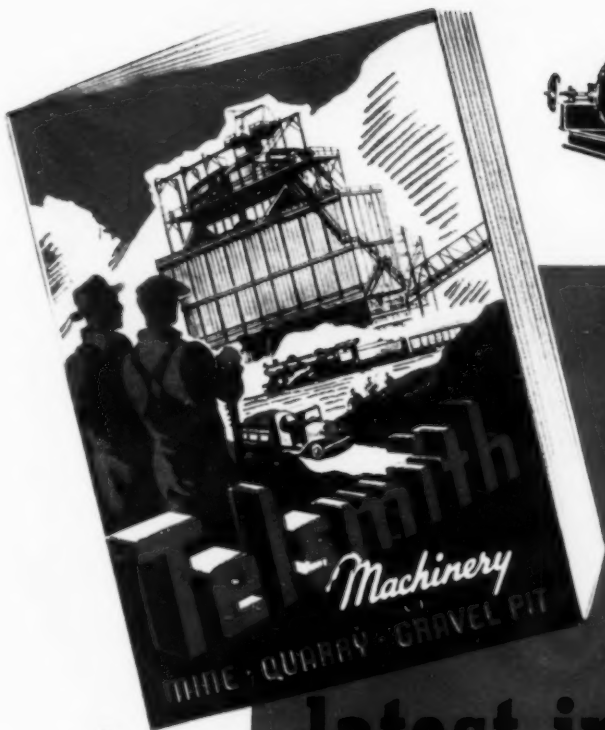
Canopy Doors

Each of the two 150-ft. wide aisles of the assembly building is equipped at the outer end with a vestibule 120 ft. deep through which assembled bomber air frames can be moved without exposing the rest of the building to drafts. The vestibules are fitted with canopy doors 143 ft. 9 in. wide which fold upward to provide a vertical clearance of more than 33 ft. Under a \$260,000 competitive-bid contract, the Byrne Doors, Inc., Detroit, is manufacturing and installing the canopy doors.

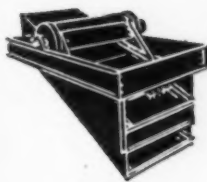
Steel Sash

Mullions of the steel sash, supplied by the Detroit Steel Products Co. under a

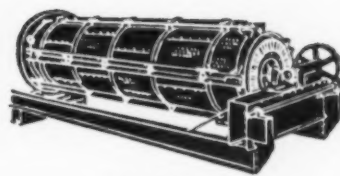
(Continued on page 102)



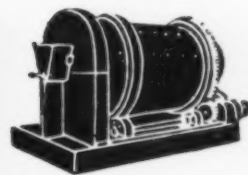
WASHING SCREENS



PULSATORS



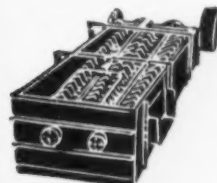
DRY SCREENS



SUPER SCRUBBERS



SCREW REWASHERS



LOG WASHERS



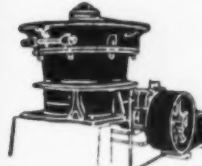
SAND TANKS



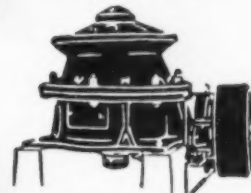
SAND DRAGS



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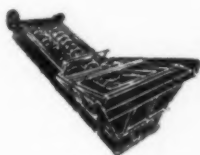
Cable Address: Sengwerk, Milwaukee—Concrete, London
Rm. 1604—30 E. 42nd St. 211 W. Wacker Drive
New York City Chicago, Ill.
715 Commercial Trust Bldg. 19-21 Charles St.
Philadelphia, Pa. Cambridge, Mass.
Vern Wheeler Esgt. Co. Brandeis M. & S. Co.
Columbus, Ohio Louisville, Ky.
Charleston Tractor & Esgt. Corp.
Charleston, W. Va.
Roanoke Trac. & Esgt. Co. Chas. C. & M. Co.
Roanoke, Va. Memphis, Tenn.
Wham-Weener-Wilkinson Co.
Knoxville and Nashville, Tenn.
G. F. Sealey & Co., Toronto, Ont.



BELT AND
BUCKET ELEVATORS

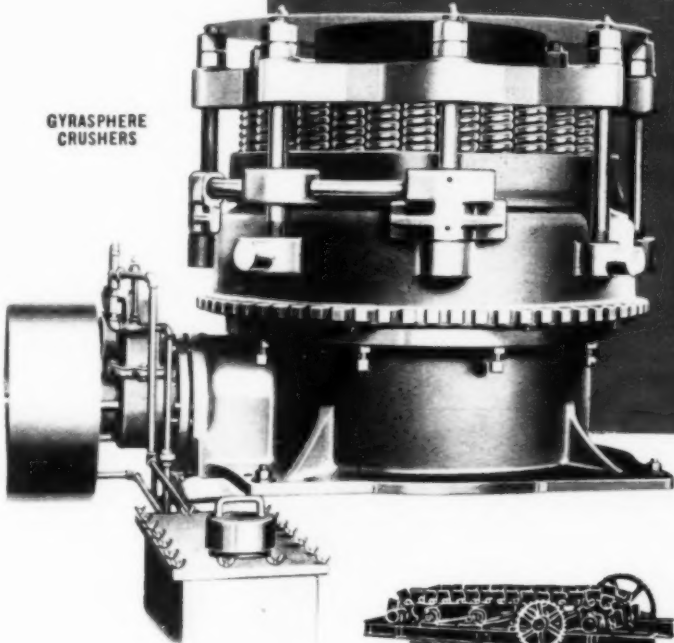


GRIZZLIES

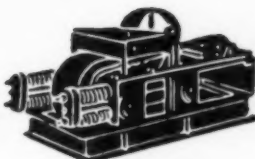


SAND CLASSIFIERS

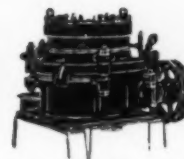
GYRASPHERE
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HEAVY DUTY FEEDERS



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here's the way to THAW FROZEN GROUND!

Last Spring a Minneapolis contractor faced the problem of thawing several thousand feet of frozen ground for concrete floor after building was enclosed. Customary use of coke fires would have been impossible due to smoke and gas. Time was extremely important. As shown in the illustration, he put a battery of MAHR No. 101 Torches to work and had the ground thawed to proper depth in a remarkably short time with no smoke or gas, no inconvenience and at small expense.

The MAHR Safety Vacuum Torch has been doing a remarkable job of producing intense heat quickly and economically for over 25 years.

**WRITE US
FOR COMPLETE
DESCRIPTION
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MAHR Safety Vacuum TORCH OUTFIT

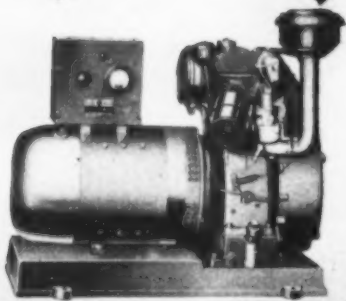
★ Thaws frozen ground in one-third usual time. Dries sand. Melts tar on tools, etc. Burns weeds. Does flame priming.

★ Throws flame 7' to 8'—intensely hot! Burns kerosene or distillate. SAFE. No pressure. Uses compressed air.

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Complete Lists Covering Industry's Major Markets

(Continued from page 100)

competitive-bid contract valued at \$85,000, are fitted with clips in which wood strips can be inserted to fasten wooden blackout shutters in case of need. Present contracts do not include the shutters. The Steel Window Service, Detroit, is erecting the sash on a \$25,000 contract awarded after competitive bidding.

Other Contracts

Creosoted wood block flooring, 2½ in. thick, 16-lb. treatment, is being placed on concrete slab throughout the entire building by the Jennison-Wright Co., Detroit, under a competitive-bid contract valued at \$550,000. The Armand Cassill Co., Detroit, by the middle of September had laid 3 mi. of railroad track to serve the plant, the installation being made on the basis of an \$85,000 contract received after competitive bidding. Concrete supply firms are using 2 mi. of temporary track for delivery of materials.

Under other competitive-bid contracts, Taylor & Gaskin, Detroit, are providing \$232,000 worth of miscellaneous ironwork, the Wickes Boiler Co., Detroit, is installing in the power house, for \$249,000, three complete oil-fired boiler units with individual capacities of 60,000 lb. of steam per hour at 175-lb. pressure, and the Cyclone Fence Co. is erecting about \$65,000 worth of 7-ft. woven wire fence.

Underpinning

As already mentioned, construction was started and pushed vigorously before complete plans and details became available. Footings and steel framing for Section 1 of the building had been well started before final machinery layouts for the manufacturing area in this section were completed. As finally laid out, the shop plans called for press pits in the area where construction already had shown considerable progress, making it necessary to underpin adjacent column footings to increased depth.

Progress

Clearing of the site was begun April 21, 1941, by the J. A. Utley Co. on order of the Ford Motor Co. A general fixed-fee contract was awarded to the Bryant & Detwiler Co. on July 20. Completion of the plant is scheduled for February 1, 1942, with production of bomber air frames to start before May 1.

Planning and construction of the plant were carried forward independently by the Ford Motor Co. until June 25, when it entered into a lease agreement with the Defense Plant Corporation, which then assumed ownership and responsibility for costs of construction. Since June 25, the Ford Motor Co. has been acting for and in behalf of the Defense Plant Corporation in managing the job.

Administration

As general administrator in charge of construction, the Defense Plant Corporation is represented at the site by Robert H.

(Continued on page 104)

300,000 sq. ft. of Cement Floor Completed in Record Time



Above: WHITEMAN Machines finish cement floors at new factory addition, Vought-Sikorsky Division, United Aircraft Corporation, Stratford, Conn. Architect-Engineer: Albert Kahn, Inc., Detroit. General Contractor: Edwin Moss & Son, Inc., Bridgeport, Conn. Below: Vought-Sikorsky scout observation plane. Bottom photo: View of assembly line in new factory addition after completion.

with "Incor" 24-Hour Cement and WHITEMAN MACHINE FINISHERS

At the new plant of United Aircraft's Vought-Sikorsky Division, Edwin Moss & Son, Inc., General Contractor, used Lone Star's "Incor" 24-Hour Cement for heavy-duty floors — then machine-finished the concrete surfaces for heavy-duty service. Three WHITEMAN machines finished the entire 300,000 sq. ft., producing a harder, smoother floor in half the time and at lower cost.

Edwin Moss, president of the contracting firm which has used WHITEMAN machines on other work as well, has this to say: "These machines (WHITEMAN Cement Floor Finishers) have worked out very satisfactorily on our jobs."

Finishing all kinds of cement floors — whether rush jobs or not — WHITEMAN FINISHERS speed up the job, cover 1,000 sq. ft. of floor in 15 minutes or less. Due to the swift action of the rotating, adjustable pitch steel trowels, WHITEMAN MACHINE finished cement floors are stronger, denser, and non-dusting; the surfaces are absolutely level.

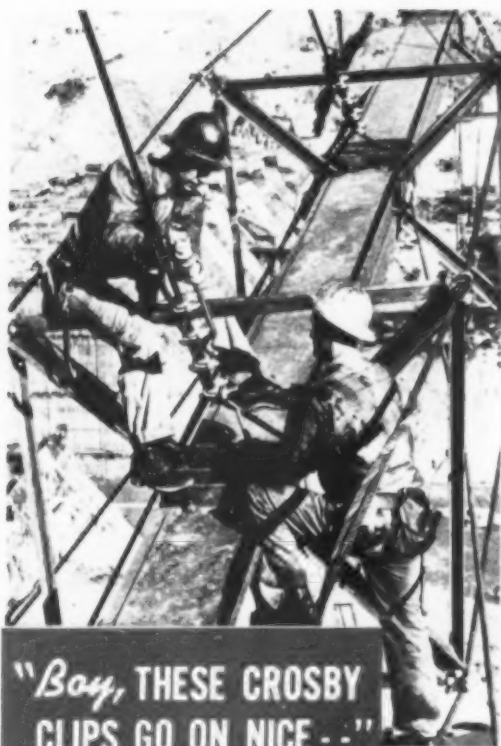
Whatever the type of construction you have at hand, it will pay you to investigate the advantages of WHITEMAN FINISHERS for YOUR job. Used on projects all over the country, these faster machines speed up the work — produce a better, more wear-resistant floor.

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"Yeh, AND THEY
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"When it comes to poker I'll bet my shirt, but for fastening wire rope I want Genuine CROSBY CLIPS and nothing else but."

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AMERICAN TERRY DERRICK CO. SOUTH KENNY, N. J.

(Continued from page 102)

Dailey, supervising engineer. For the Ford Motor Co., engineering and field operations come under the direction of H. B. Hanson, who is in charge of power and construction work of the motor manufacturing concern. In the organization of Albert Kahn Associated Architects & Engineers, Inc., the executive principally responsible for decisions on construction of the bomber plant is George Scrymgeour, with Raymond C. Bernardi, superintendent, in charge at the site. The Bryant & Detwiler Co. has Charles M. Reik, a member of the firm, acting as its representative on the bomber plant, with John G. Campbell as general superintendent of the firm's job operations and J. K. Calder directing and coordinating all of the trades.

★ ★ ★

Pumped Concrete

FOR PHILADELPHIA ARMY WAREHOUSE

(Continued from page 50)

install the necessary reinforcing steel and electrical conduits, in addition to pouring concrete columns and finishing slabs.

Concrete Pouring Requirements—Assuming three days per week for pouring slabs of 15,000 sq. ft. each—a reasonable assumption on account of the monolithic finishing requirements—the delivery, hoisting and distribution of 600 cu. yd. of concrete in about 6 hr. was vitally important. This was probably the biggest single factor governing the speed of operations. Preparatory work, such as form erection and placing reinforcing steel, was more or less a matter of labor manipulation. The labor situation was reasonable throughout, but it was necessary to finish pouring slabs not later than 2:30 p.m., in order to avoid excessive overtime for cement finishers.

To raise and distribute 100 yd. of concrete per hour on this building would have required 4 hoisting towers working simultaneously and from 400 to 500 ft. of runways with 8 or more buggies for each tower. For the entire job at least 11 hoisting towers and the maintenance of temporary roads would have been necessary to serve concreting operations adequately. The most serious problem, however, was the unsteady delivery of concrete, to be expected from traffic congestion within the premises, aggravated both by depot operations and the cutting up of roadways for the installation of underground utility piping. The delivery and disposal of this amount of concrete under the conditions

outlined would have required functioning with clock-like regularity. Traffic problem or not, the prescribed volume of concrete had to be poured within the regular working hours.

It will be observed in the progress chart that the line of actual work dropped below the assumed progress line around June 7. Thereafter, the actual and assumed progress lines became parallel. The drop was caused by the inability of the manufacturer to supply reinforcing steel for a period of more than two weeks at this particular time.

Plant Setup

Having had some considerable experience with the use of concrete pumps, the writer realized that if the pumping system had any value for building construction, this warehouse presented ideal conditions for its use. Analyses of rentals, operation and incidental costs of the pumping methods were quite favorable in comparison with like costs for the "horse and buggy" method. So, with the endorsement of Major Clyde B. Pyle, constructing quartermaster, no time was lost in securing two Model 200 dual Rex Pumperetes; this model, delivering through an 8-in.-diameter pipe line, has a capacity of approximately 60 cu. yd. per hour. It seemed almost unbelievably good fortune in these times of equipment scarcity to locate two of these machines together, but find them we did. The Pumperetes were set up in a battery, near the center and facing the south side of the building, one behind the other, so that two overhead receiving hoppers of 6-yd. capacity (maximum truck load) could discharge concrete into each machine's remixing hopper by means of manually operated gates. Each hopper was emptied completely before the next was allowed to discharge.

Ready-Mix concrete was supplied by the Warner Co. in 6-yd. truck-mixers which discharged into the collecting hoppers by backing up an earth ramp on a 6-per cent grade. The ramp was paved with 4-in. planks and was wide enough for two trucks to discharge side by side. The pumping plant was located opposite the old Penrose Road gate, which is used for incoming construction trucks only. Emptied trucks went out through the construction gate at the east end of the building. Thus, no concrete truck serving the pumping plant was obliged to dodge around the premises among the freight-car-size trucks serving the depot with other materials. Concrete delivery was thus reduced to its simplest terms. Minimizing the roadway space required for concrete delivery also gained another advantage in that the entire ground area to the north of the plant, and elsewhere, was released for the early installation of underground utilities. This facilitated laying concrete pavement and railway sidings long before completion of the building. It also provided sorely needed storage space.

From the plant location it was possible to use one pumping machine intermittently for pouring part of first and second-floor slabs on an adjacent 160x1084-ft.

(Continued on page 106)

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fast

For saving time on the job, for saving time between jobs — doing **BIG** things in a **BIG** way **FAST** — you can't beat husky, dependable shovels and cranes that travel everywhere under their own power! They roll on extra heavy 6-Wheel Chassis with Timken front and Timken Tandem Drive Rear Axle Units, engineered and built to stand up under the gruelling punishment of today's demands. Investigate mobile shovels and cranes equipped with Timken 6-Wheelers now!

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THE TIMKEN-DETROIT AXLE COMPANY, DETROIT, MICH.
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Photo courtesy of
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Shovel Company



Photo courtesy of Bay City Shovels, Inc.



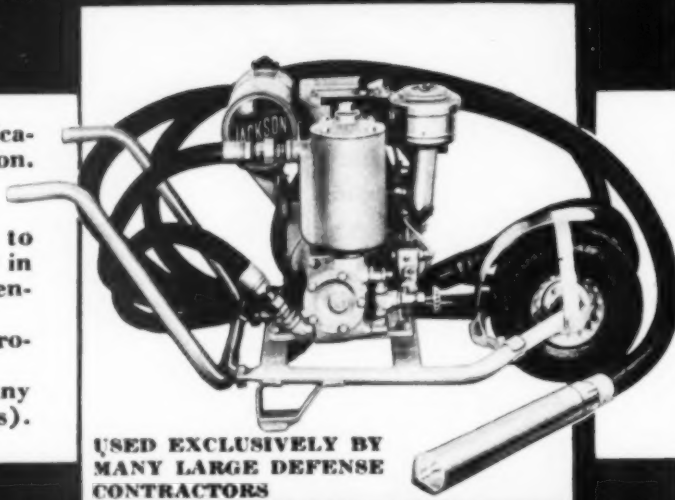
Photo courtesy of Thew Shovel Company

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profitably... GET DEPENDABLE
EQUIPMENT ... Buy the Fast ...

JACKSON Hydraulic Concrete Vibrator

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Automatic pressure lubrication—requires no attention.
34-ft. hose—2 3/4" vibrator head.
Adjustable frequency to 6800 R.P.M.—submerged in concrete. Powerful gas engine—4.7 H.P.
Long lived, ball-bearing, rotary, hydraulic pump.
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Special jobs often require special tools and while rock handling problems are doubtless common to many, OWEN has perfected and proved the special tool for this job in the Type RA Rock Grapple. Revolutionary, independent line action, enormous lifting capacity and other exclusive features distinguish it decidedly from other equipment intended for like use.

Write for the new catalog, just off the press.

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Branches: New York, Chicago, Philadelphia, Berkeley, Cal.

(Continued from page 104)

two-story inspection building. This building lies at a right angle to, and on the north side of the warehouse under discussion, the two buildings forming a giant T.

Concrete Pumped 700 Ft.

The maximum length of pipe line for pumped concrete delivery was about 700 lin.ft., with a 60-ft. vertical lift to the concrete roof of the warehouse. The day the accompanying photographs were taken the two Pumcretees delivered 800 cu.yd. of concrete to the fourth floor in 7 hr. and 10 min., covering an area of 20,000 sq.ft. This is a feat difficult to duplicate by other methods. It is also noticeable in one of the pictures that instead of having at least one-quarter of the deck covered by runways for buggies, the entire pouring area is clear. This means that the straightening of disarranged reinforcing steel, filling up slots left in the deck to provide for swelling boards, etc., can be accomplished without the customary difficulty where runways cover so much of the deck area. It also assures a clean deck during concreting operations. Incidentally, storage space for runways, hoppers and buggies would have been difficult to find on this particular building, because shores to support the next floor were set up on all slabs within 24 hr. after pouring.

No trouble was experienced with blocked pipes or anything of a like nature. After all, the Pumcretee is nothing but a piece of power-driven machinery, simple in theory and mechanism. Just as any other machinery, however, it must be overhauled periodically and the wearing parts coming into contact with concrete must be replaced after a certain period to insure maximum dependable performance. Considering all angles and barring unexpected incidents in pouring the final few thousand yards remaining at this writing to finish construction, the unit cost of labor and equipment chargeable to concrete has been very much less on this warehouse than for any other structure that has been finished on the project.

Vacuum Process Applied

All slabs are monolithically finished. In order to avoid laitance, a considerable amount of which can be expected in the case of slabs 10 in. thick, the floor finish process of the Vacuum Concrete Corp. for the removal of excess mixing water from the concrete in place has been employed. The vacuum pads, plainly visible in one of the pictures, were applied just as soon as possible after the concrete was levelled off. Laitance troweled into the finished surface becomes a nuisance and the cause of dusting floors. In concrete devoid of free water, laitance has small chance to come to the surface and the vacuum process, by eliminating excess water quickly, appears to be the answer to the problem.

Personnel

The four-story concrete warehouse, as well as a number of other large buildings

(Continued on page 109)

Only 8 of 17 Points for

**HAZARD
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Preformed

PREFORMED WIRE ROPE

4. The load on a **PREFORMED** wire rope is distributed equally to each strand, and to each wire in every strand. The rope is safer under load, lasts longer and maintains the safety factor better.
5. When outer wires break they do not stand up, from the surface of the rope to injure workmen, sheaves and the rope itself.
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8. **PREFORMED** wire ropes, in stretching, do not suffer change in length of lay. Strands are merely bedded firmly to the core.
9. **PREFORMED** wire ropes do not rotate in the sheaves to the same extent as non-preformed ropes.
10. **PREFORMED** wire ropes resist the whipping associated with vibration.
11. **PREFORMED** wire ropes permit more "fool proof" attachment of sockets, helping workmen to attach the sockets without unbalancing the rope lays below the socket bases.



PAGE 87

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• Being preformed (and the first rope to be preformed under the assigned patents) Hazard LAY-SET has repeatedly proved up on all seventeen points in practically all applications. LAY-SET **PREFORMED** is backed by 96 years of rope-making experience and by a company that has clung so tenaciously to quality materials, manufacture and service that it has on its books many firms who have used Hazard ropes continuously for 40, 50 and 60 years. All Hazard ropes identified by the Green Strand are made of Improved Plow Steel.

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FOR MORE YARDAGE AND LOWER COSTS ON LONG HAULS YOU NEED TOURNAPULLS

Tournapulls extend tractor-scraper economies to your longer hauls. Like big-capacity LeTourneau Carryalls, they are quickly pusher loaded. They haul at fast construction speeds (up to 14.3 m.p.h.) and spread their own loads, thus eliminate shovels and elevating graders for loading and 'dozers for spreading out the fill.

More Traction — High Average Speeds

Tournapull weight (plus 40% of the Carryall and its load) is centered on the drive wheels to give you the greatest possible tractive power. That means plenty of surplus rimpull for quick acceleration to top speed or for

pulling through tough spots. Result—*high average speeds* and more *big loads hourly*.

Easy, Simple Operation

Just as tiller wheels have been discarded on track-type tractors, so LeTourneau has eliminated front steering wheels on Tournapulls. You pull and steer with the same wheels, just as you do with tracks on a track-type tractor. There are no front wheels to bog down when traveling or turning in mud or sand. Two-wheel design enables you to turn faster and sharper. Big brakes on both Tournapull and Carryall assure quick stopping and complete control on grades. Same

fast, sure-acting LeTourneau cable control that has proved so popular on tractors, makes Tournapull-Carryall operation easy, too.

400 Model C's in Use

Today more than 400 Model C and Super C Tournapulls are in use, cutting costs on long hauls for hard headed, profit-minded earthmovers in 37 states and several foreign countries. Tournapulls can do the same for you — see your LeTourneau-"Caterpillar" distributor for complete details NOW.

Loading common earth on the level with a "Caterpillar" D8 pusher and hauling over good roadways, you can expect the following yardages in a 60-minute hour from Tournapulls:

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For Lowest Net Cost per Yard—CARRYALL* SCRAPERS, ANGLEDZERS*, POWER CONTROL UNITS, BULLDOZERS, ROOTERS*, TRACTOR CRANES, PUSHDOZERS, TOURNAPULLS*, SHEEP'S FOOT ROLLERS, TOURNATRAILERS*, TOURNACRANE.

*Name Reg. U. S. Pat. Off.

DIRT FLIES at Candler Field, Atlanta, Georgia, where six Tournapulls took over the long-haul earthmoving. Here's a Model C Tournapull high-balling 11 heaped yards to the fill at 14 m.p.h. 4 LeTourneau 13-yard Carryalls and 2 'Dozers are handling the shorter hauls on this 1,380,000-yard defense project for C. M. Lyle Const.Co.

THESE PROFIT-MAKING YARDAGES CAN BE YOURS WITH TOURNAPULLS				
Haul- One Way	98 H.P. Model C (11 yards heaped)		150 H.P. Super C (15 yards heaped)	
	Trips	Pay Yards	Trips	Pay Yards
600	17.1	150	15.0	180
1200	14.0	119	12.0	144
1600	12.3	104	10.7	129
2000	10.9	93	9.7	116
3000	8.4	71	7.6	91
5000	5.8	50	5.4	65

(Continued from page 106)

erected under the same contract, was built by Wark & Co., of Philadelphia, under the direction of Major Clyde B. Pyle, representing the U.S. Army as Constructing Quartermaster. The contractor's field organization included W. R. Heritage, office manager; G. M. Reaves, project manager; and C. M. Scott, general superintendent. The Ballinger Co., of Philadelphia, served as architects and engineers on the project.

★ ★ ★

Horizontal Single Wall Design FOR RAVENNA DEFENSE HOUSING

(Continued from page 54)

or gable ends. On a large dormitory, the labor cost of trimming off any excess at gable ends does not mean a large percentage increase in the unit labor cost of erecting the roofing; the panels fit perfectly from eave to ridge without any cutting.

Each panel has an overall length of 7 ft. 1 1/4 in. and an overall width of 16 in., with 13-in. exposure. The interlocking feature consists of a tapered upper edge which fits into a groove under a 3-in. headlock overlap at the lower edge of the next higher course. Six nails are used at the upper edge only to attach a panel to the roof rafters. Driving of these nails tends to tighten the overlapping interlock with the next lower course of panels, creating a roof which has proved water-tight against hose streams and wind-tight even against prying with pinch bars. Butting edges of adjacent panels in the same course are sealed by overlapping the 90-lb. roofing felt which covers the compressed cellulose core of the roofing material. Average overall thickness of the roofing panel, including the 90-lb. felt cover, is 3/4 in.

Structural Features

Foundations for the Ravenna dormitories and for other buildings employing the horizontal, single-wall construction consist of concrete block piers on poured concrete footings located on 12-ft. centers in both directions. Floor framing in the dormitories comprises double 2x12-in. girders running transversely across the buildings in the 24-ft. direction and supporting on attached ledgers or 3x8-in. steel stirrups 2x12-in. floor joist on 24-in. centers.

In the front and back walls of the building, 4x4-in. exterior columns set on 12-ft. centers support glued and pressed built-up longitudinal girders comprising a 1/2-in. plywood web with a continuous top

plate and a continuous bottom girt glued on to form a roughly channel-shaped section. These girders carry job-fabricated roof trusses on 24-in. centers. The girders and a horizontal girt 4 ft. below the bottom of the girder are erected prior to the application of wall panels, the intermediate girt being supported temporarily by attachment to the columns pending erection of the Cemesto board. Slight modifications in the standard design are made for demountable construction, and screws and double-headed nails are used to facilitate disassembly.

Windows may be installed at any location in the horizontal band between the plywood girder and the intermediate horizontal girt. Wall panels are manufactured and cut at the mill to accurate dimensions for field assembly. A panel for the lower course between columns measures 4x12 ft. Most construction joints are concealed by door and window frames. Those not concealed are calked and covered with asbestos-cement battens.

Licensing Control

To prevent exploitation of horizontal, single-wall construction by jerry-builders who might give it a bad name, the John B. Pierce Foundation patented the procedure. Once the Foundation had completed the research, development and demonstration work necessary to establish the process, the Celotex Corp., under agreement with the patent owner, logically undertook the promotion and selling job, retaining the same architectural firm, Skidmore, Owings & Merrill, which had collaborated with the Housing Research Division of the Foundation in developing the horizontal, single-wall construction. The Celotex Corp. is empowered to grant licenses for specific projects to builders who satisfy the requirements of ability, integrity and financial responsibility demanded by the patent owner. For the John B. Pierce Foundation, all licensing authority for commercial applications of Foundation developments is under the control of J. F. O'Brien, general manager.

Prefabrication Policies

Economy governed the development of all fabricating and erecting plans for the horizontal, single-wall construction. Prefabrication and pre-cutting at the mill were utilized only where they showed an actual cost advantage as demonstrated by comprehensive studies of complete time and cost records developed during the construction of buildings. These studies showed a saving in prefabrication and pre-dimensioning of certain items at the mill and demonstrated similar economy for the cutting and fabricating of other items at the site.

Accurate dimensioning of columns, girders, and wall panels at the mill means a saving on the job, as also does the use of completely assembled windows with screens, weatherstripping and hardware in place. On the other hand, pre-cutting of rough lumber and millwork means a loss,

(Continued on page 112)

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Re: COSTS

"The following Comparison of Cost uses two mixes whose general working qualities are very similar, with a slight superiority in favor of Mix B, with Pozzolith added.

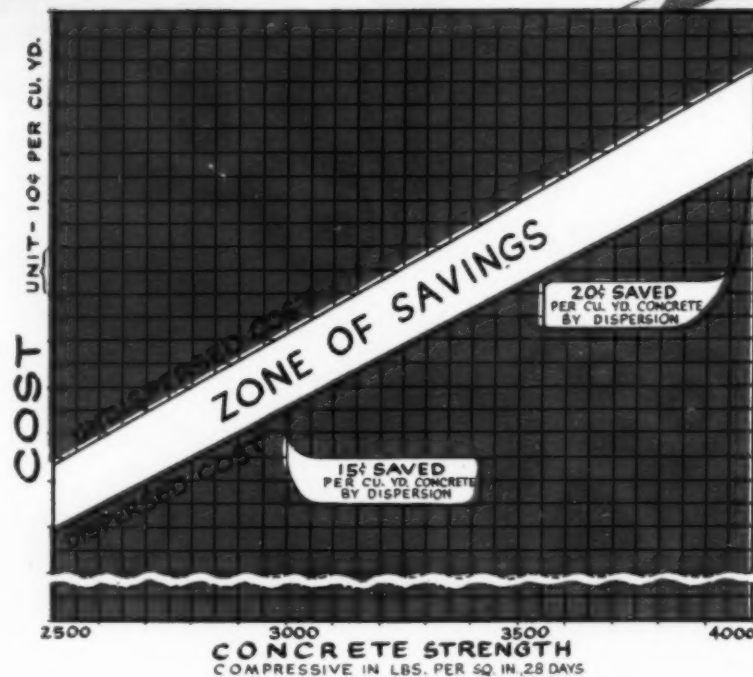
A — No Admix	-	\$5.775 per cu. yd.
B — With Pozzolith	-	5.248 per cu. yd.
Saving per cu. yd.	-	\$.527

A saving in finishing time developed, particularly when using Mix "A" with Pozzolith added :

Unit saving, Mix "A" plus Pozzolith	-	-	29c per sq. yd.	-	-	\$1.75 per cu. yd.
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Re: QUALITY

The amount of water used in the regular mix is reduced on the average of 5.7 gallons per cu. yd. with the use of Pozzolith. This reduced water content increases density and water-tightness. In spite of the lowered water content noted above, plasticity is greatly increased making finishing easier and quicker. Bleeding is entirely eliminated when Mix "A" is used with Pozzolith and almost entirely so using Mix "B". Shrinkage is also reduced" . . .



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(Continued from page 109)

as more time is consumed by workmen in trying to find dimensioned pieces than in cutting pieces to fit.

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For each kind of building, the plans include complete bills of materials broken down in accordance with the departments into which the work is divided. Cross-sections of all materials are shown, whether they are stock items or not.

Man-hour records for actual construction of completed jobs also are available, although they are offered merely for guidance and are in no sense guaranteed.

Dormitory Construction

Accompanying photographs indicate salient features of the construction of the dormitories at Ravenna. Although complete figures on the Ravenna job are not available, it may be said on the basis of experience by the same contractor in erecting five dormitories at Middle River, Md., that a trained organization comprising twelve carpenters and eight laborers can complete a dormitory building above foundations in 7 days.

Dormitory buildings are T-shaped, with a main section 168 ft. long by 24 ft. wide, and a wing 72 ft. long by 24 ft. wide. Each dormitory provides accommodations for 61 women in 34 rooms. A crew of nine men can complete interior partitions, excepting doors, for the 34 rooms of a dormitory in one day and 3 hr. The working day used in these reported estimates is 8 hr.

Direction—Horizontal, single-wall construction was developed by a staff working in collaboration with the consulting architects, Skidmore, Owings & Merrill, under the guidance of Robert L. Davison, director of housing research for the John B. Pierce Foundation, New York City, which holds a patent on the procedure. Application of the patented construction is being promoted under agreement with the John B. Pierce Foundation by the Celotex Corp., Chicago.

At Ravenna, Ohio, the eight dormitory buildings to house 488 women employees of the Ravenna Ordnance Works were completed for the Farm Security Administration by the Housing Engineering Corp., Baltimore, Md., under the field supervision of Reed O'Meara, superintendent. G. Earl Mason was superintendent for the Farm Security Administration, of which John F. Donovan is chief engineer.

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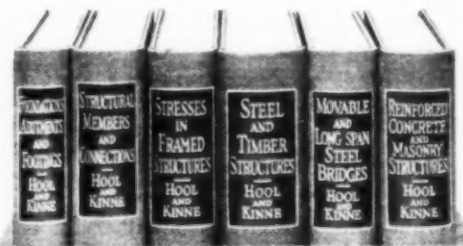
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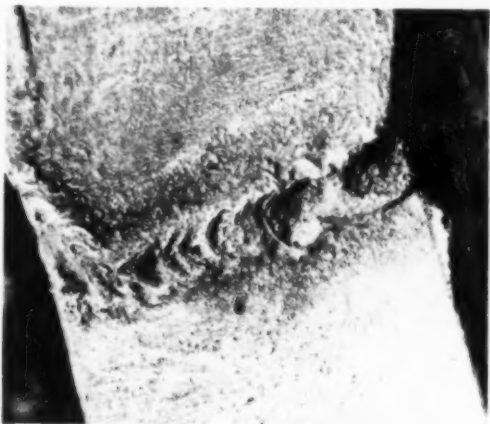
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CONSTRUCTION EQUIPMENT NEWS... *Continued*

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sary. Welded products may thus be manufactured from galvanized sheets or shapes, eliminating dipping finished product to assure making it rust-proof. Additional feature: permits painting or enameling of welded joint without danger of sweating. Necessity of applying filler coat before finishing joint is eliminated. Galv-Weld surface may be baked. Of particular interest to ship-building and general contracting trades, and to builders of prefabricated houses.—Galv-Weld, Inc., Mutual Home Bldg., Dayton, Ohio.

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COMBINATION SHOVEL-DRAGLINE-CRANE, available either with gas, oil or electric power unit, when used as shovel is equipped with 21-ft. boom, 17-ft. dipper handle and 1½-yd. dipper. As crane, it has maximum lifting capacity of 25 tons. Equipped with inside expanding clutches with housings cooled through radiation fins. Hoist clutches are equipped



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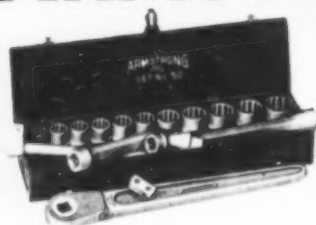


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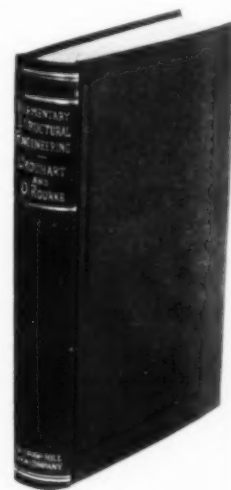
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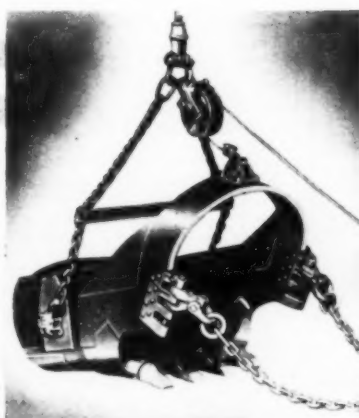
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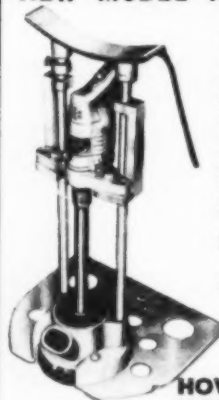
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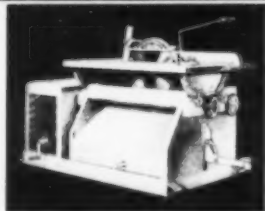
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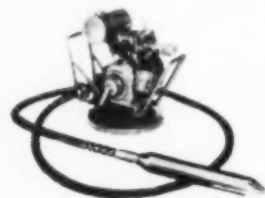
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WIRE ROPE HANDBOOK—**Macwhyte Co., Kenosha, Wis.** (166 pp., 4x6¼-in. size, illustrated.) Combines catalog, handbook, price lists, tables and data helpful to wire-rope users. Material in booklet is sectionalized, with tabbed index for quick reference. Contents include preformed wire rope, internal lubrication, haulage and hoisting ropes of various sizes and types, non-corrosive ropes, wire-rope slings, and fittings. Section of "General Information" deals with wire-rope terms, types of rope construction, lays, working loads, safety factors, recommended sheave diameters, sheave maintenance, correct spooling of rope on drum, and wire rope sockets. Several pages describe manufacture of wire rope.

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BRIDGE RAILINGS—**American Institute of Steel Construction, 101 Park Ave., New York, N. Y.** (24 pp., illustrated.) Summarizes results of engineering studies of design and construction of steel bridge railings. Covers both practical and aesthetic features. Discussion of design with relation to possibilities of collision by vehicles. Sketches show typical details of various types of structural steel railings.

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WELDING PROCEDURES—**Air Reduction Sales Co., Lincoln Building, New York, N. Y.** (54 pp., illustrated.) In addition to suggesting proper welding



process for particular metal under various circumstances, this book recommends best filler metals to be used for each process, and describes specialized welding techniques not commonly known. In an appendix, data is given for calculation of electrode and gas welding rod consumption for different types of welds; also comparative welding record sheets for tabulating data that will determine best welding method for particular job. Metals are grouped alphabetically under such headings as aluminum, die cast metals, malleable iron, steel, wrought iron, etc. For each analysis of each metal, (such as high carbon steels, medium carbon steels, low carbon steels) recommendations of process, of filler rod, and special technique are given. Where choice exists between two or more processes, operator is prone to use process in which he is most adept, without stopping to consider ultimate costs. By use of cost data sheets in book and by gaining a keener appreciation of fields for which gas or arc welding are particularly fitted, operator will be able to produce better welds at less cost.

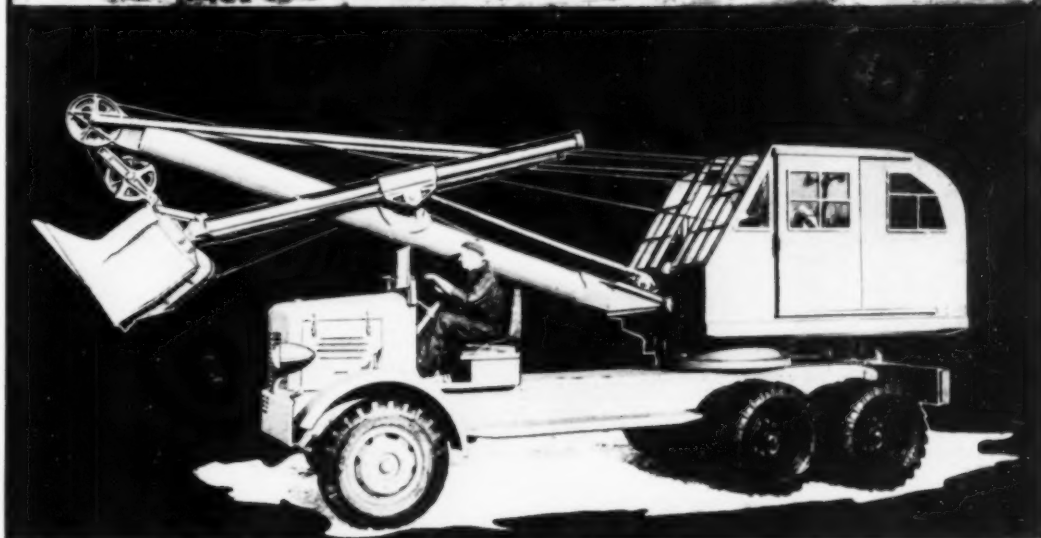


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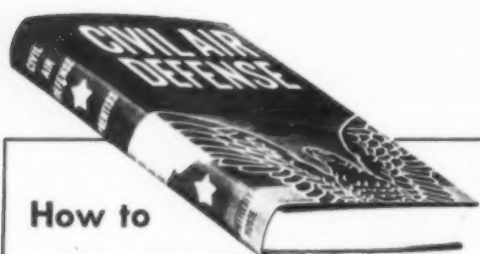
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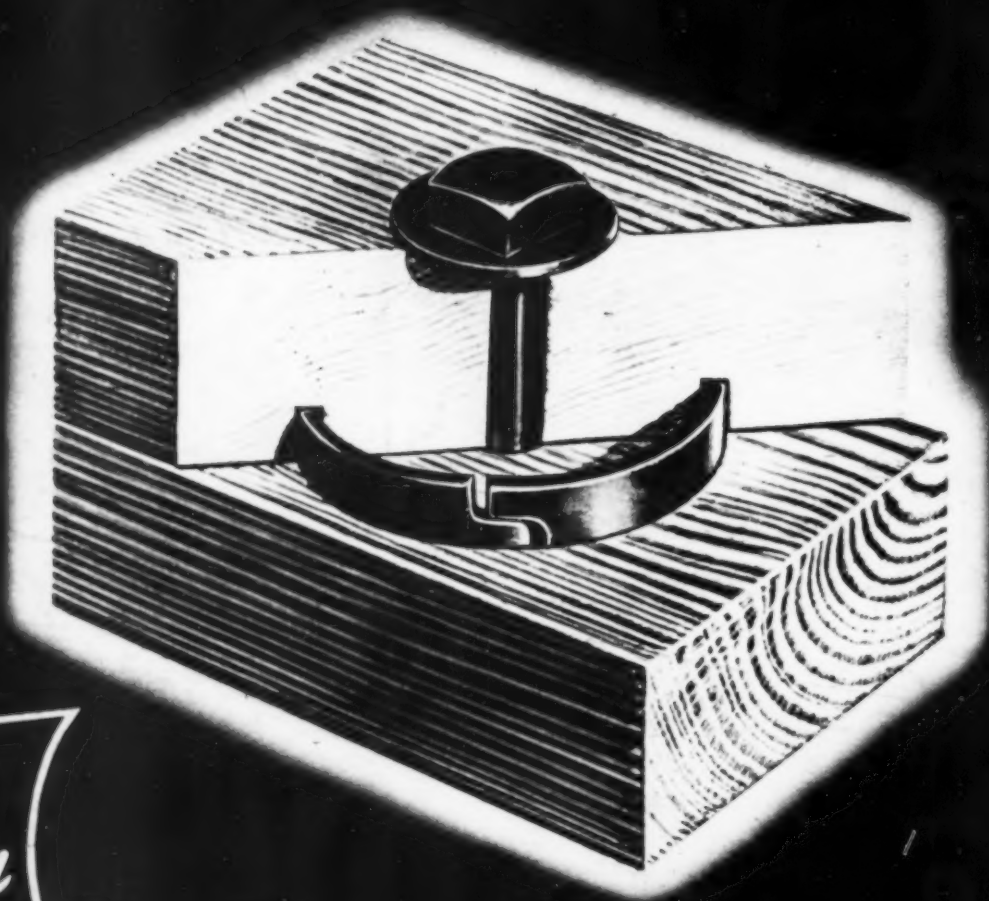
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